REPORT

OF THE

INTERNATIONAL SCIENTIFIC COMMISSION

FOR THE

INVESTIGATION OF THE FACTS CONCERNING BACTERIAL WARFARE IN KOREA AND CHINA

(With Appendices)

PEKING

1952

R E P O R T

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Preamble

From the beginning of 1952, phenomena of a very unusual character occurring in the territories of Korea and China led to allegations by the peoples and governments of those countries that they had become the objective of bacteriological warfare.

Since the peoples of the world had long manifested their disapproval, and indeed detestation, of such methods of war, the gravity of the situation was well understood. This was the reason for the formation of an International Scientific Commission which should examine the evidence in the field.

The members of the Commission, who, conscious of their responsibility, made every effort to free themselves from preconceived ideas, have carried out their investigations according to the strictest scientific principles known to them. The details of this work, and the conclusions to which it has led, are placed before the reader in the present Report. In its composition eight languages have participated, and if it should be found lacking in elegance, the reader will remember that it had to be clear, unambiguous, and comprehensible in every continent.

Formation and Work of the Commission

On the 22nd. Feb. 1952, Mr. Bak Hun-Yung, Foreign Minister of the Democratic People's Republic of Korea, and on the 8th. March, Mr. Chou En-Lai, Foreign Minister of the People's Republic of China, protested officially against the use of bacteriological warfare by the U.S.A. On the 25th. Feb., Dr. Kuo Mo-Jo, President of the Chinese People's Committee for World Peace, addressed an appeal to the World Peace Council.

At the meeting of the Executive Committee of the World Peace Council held at Oslo on the 29th. March, Dr. Kuo Mo-Jo, with the assistance of the Chinese delegates who accompanied him, and in the presence of the Korean representative, Mr. Li Ki-Ien, placed the members of the Committee, and other national delegates, in possession of much information concerning the phenomena in question. Dr. Kuo declared that the governments of China and (North) Korea did not consider the International Red Cross Committee sufficiently free from political influence to be capable of instituting an unbiassed enquiry in the field. This objection was later extended to the World Health Organisation, as a specialised agency of the United Nations. However, the two governments were entirely desirous of inviting an international group of impartial and independent scientists to proceed to China and to investigate personally the facts on which the allegations were based. They might or might not be connected with organisations working for peace, but they would naturally be persons known for their devotion to humanitarian causes. The group would have the mission of verifying or invalidating the allegations. After thorough discussion, the Executive Committee adopted unanimously a resolution calling for the formation of such an International Scientific Commission.

Efforts were therefore made immediately after the Oslo meeting to obtain the acceptances of a considerable number of European, South American, and Indian scientists, as eminent as possible in the relevant fields. As soon as the provisional acceptances were known, Dr. Tsien San-Tsiang, Director of the Institute of Modern Physics of Academia Sinica (the Chinese National Academy), and a member of the Chinese Peace Committee, who had remained in Europe after the Oslo meeting charged with the work of organising the Commission, issued invitations in the name of Dr. Kuo Mo-Jo, President of Academia Sinica and of the Chinese Peace Committee. The indispensable minimum of members having been reached by mid-June, they duly proceeded to China.

The International Scientific Commission reached Peking on the 21st. and 28th. June, where its members were warmly welcomed by representatives of Academia Sinica and the Chinese Peace Committee. The members were as follows:—

Dr. Andrea ANDREEN (Sweden), Director of the Central Clinical Laboratory of the Hospitals Board of the City of Stockholm.

Mons. Jean MALTERRE (France), Ingenieur-Agricole, Director of the Laboratory of Animal Physiology, National College of Agriculture, Grignon; formerly Livestock Expert, UNRRA; Corresponding Member of the Italian and Spanish Societies of Animal Husbandry.

Dr. Joseph NEEDHAM (U.K.), F.R.S., Sir William Dunn Reader in Biochemistry, University of Cambridge; formerly Counsellor (Scientific), H.B.M. Embassy, Chungking, and later Director of the Department of Natural Sciences, UNESCO.

Dr. Oliviero OLIVO (Italy), Professor of Human Anatomy in the Faculty of Medicine of the University of Bologna; formerly Lecturer in General Biology, University of Turin.

Dr. Samuel B. PESSOA (Brazil), Professor of Parasitology at the University of Sao Paulo; formerly Director of Public Health for the State of Sao Paulo; Hon. Professor in the Faculties of Medicine of the Universities of Recife and Paraiba.

Dr. N. N. ZHUKOV-VEREZHNIKOV (U.S.S.R.), Professor of Bacteriology at, and Vice-President of, the Soviet Academy of Medicine; formerly chief medical expert at the Khabarovsk Trial of Japanese ex-service men accused of participating in bacteriological warfare.

While greatly regretting that certain distinguished men of science whose participation had been expected, had not been able to come, the 15th. July was fixed by the Commission as the last date for arrival. However, later on, a warm welcome was given to

Dr. Franco GRAZIOSI (Italy), Assistant in the Institute of Microbiology, University of Rome,

who arrived in Peking on the 6th. Aug., just before the return of the Commission from Shenyang (Mukden). Since he was thus only able to be present during the last three weeks of the Commission's work, he was established in the status of Observer-Consultant, and in that capacity gave great help to the proceedings.

Finally, there participated:

Dr. TSIEN San-Tsiang (China), Director of the Institute of Modern Physics, Academia Sinica (Chinese National Academy),

who had accompanied the Commission from Europe to Peking as Dr. Kuo's representative. Upon the unanimous invitation of the Commission, he was attached by the Chinese authorities as Liaison-Member, a position which carried a voice in the deliberations of the Commission, but no vote. The group also included:

Mr. N. A. KOWALSKI, Secretary-Interpreter to Dr. Zhukov-Verezhnikov, and

Mrs. S. B. PESSOA, acting as Secretary-Interpreter to Dr. Pessoa.

The International Commission was assisted by a Committee of Reception which had been set up on the Chinese side. This was constituted as follows:

Chairman:

Madam LI Tê-Chuan, President of the Chinese Red Cross Society and Member of the World Peace Council.

Vice-Chairmen:

Mr. LIAO Ch'êng-Chih, Member of the World Peace Council.

Dr. HO Chêng, Hon. President of the Chinese Medical Association.

Secretary-General:

Dr. KUNG Nai-Ch'uan, Director of Shanghai Medical College.

Assistant Secretary-General:

Dr. CHI Su-Hua, Secretary of the Chinese Medical Association.

Specialist Liaison Officers:

Dr. CHUNG Hui-Lan, Director of the People's Hospital, Peking, and Professor of Clinical Medicine, China Union Medical College.

Dr. WU Tsai-Tung, Professor of Pathology, Nanking University Medical College.

Dr. FANG Kang, Associate Research Member, Central Research Institute of Health, Peking.

Dr. CHU Hung-Fu, Assistant Director, Laboratory of Entomology, Academia Sinica.

Dr. YEN Jen-Ying, Associate Professor of Obstetrics and Gynaecology, Peking University Medical College.

Dr. YANG Shih-Ta, Professor of Public Health, Aurora University, Shanghai.

Most of the members of the Committee accompanied the Commission upon its travels, however hazardous or arduous, and were constantly ready to perform every conceivable liaison task which the situation might demand. From time to time some of them, together with many other Chinese scientists and medical men, attended the meetings of the Commission as observers or to give evidence before it. The Commission wishes to thank all these colleagues, for whose scientific attainments and probity it conceived a deep respect.

As regards the conduct of the meetings of the Commission, the Chairmanship rotated in an approximately consecutive manner among the members. M. Malterre was elected Scientific Secretary. The first meeting of the Commission took place in Peking on the 23rd. June, and a brief chronological summary of all the meetings held will be found in App. A.

Of the general methods of the Commission it may be said that it worked in close contact with the Ministers and ministerial secretariats of the central and regional Ministries of Health at Peking, Shenyang (Mukden), and Pyongyang. It naturally had the help of all those scientists whose fields of work were relevant to the problem before it. Besides those already mentioned, the Commission wishes to thank Dr. WANG Pin and Dr. PAI Hsi-Ch'ing, Minister and Vice-Minister of Health respectively for the North-Eastern Region of China (Manchuria), who spared no pains to lay before the Commission all information that it was in their power to give. Its thanks are similarly due to Dr. RI Ping-Nam and Dr. LU Tchen-Han, Minister and Vice-Minister of Health respectively in (North) Korea, but these could not be offered without an expression of admiration for the cool manner in which these distinguished medical officials conducted all their business while suffering the constant inconveniences and dangers of heavy air bombardments.

In this connection, too, the Members of the Commission wish to voice their profound admiration for the devoted service to their country of all the Korean bacteriologists and other specialists whom they had the honour to meet during their visit. The Commission renders homage to three of the best Korean bacteriologists who have perished while carrying out their professional duties. It also wishes to place on record its admiration of the selfless service of the eminent Chinese specialists seconded to the Korean Epidemic Prevention Corps, such as Dr. CH'EN Wên-Kuei, Dr. WEI Hsi, and Dr. HO Ch'i, who thought fit to leave the quiet amenities

of their laboratories in far-away parts of China to share all the hardships and dangers of their Korean colleagues in the front line of anti-bacterial defence.

The meetings of the Commission varied in character. Sometimes the members discussed scientific problems for many hours in closed session, on other occasions Chinese scientific experts were present, and again at other times large rooms were required for the hearing of evidence of numerous eye-witnesses who came from all walks of life. Among the witnesses there figured a captured intelligence agent (App. JJ) and four airmen (App. OO). From time to time specific sub-committees of two or three members were delegated to look into particular problems in conjunction with Chinese colleagues, and then to report back to the Commission. From time to time whole days were spent in laboratories, at Peking, Shenyang, and Pyongyang, where the Chinese and Korean scientists demonstrated in great detail the results of their investigations. As occasion demanded, too, members of the Commission made use of the very good library facilities available at Peking and Shenyang.

The material on the cases prepared by the Chinese and Korean specialists forms the bulk of the Appendices to the present Report. They will be found briefly described in the paragraphs which follow. It should be understood that they are not isolated cases, but represent a sampling from a larger mass of material. If the bulk of what is here presented is Chinese rather than Korean, this is because the Koreans were working under far more difficult conditions, and because the Commission was in Korea for a shorter time, and indeed at a particularly difficult moment.

At the same time the Commission felt that it must familiarise itself with the original scientific data which had formed the basis for the documentation issued from Prague during the earlier part of the year. It was necessary that these documents should be validated or otherwise, if possible, and it proved that clarifications were indeed necessary; misunderstandings, tentative identifications afterwards withdrawn, sheer mistakes of translation, etc. being found. After a great deal of work along these lines, the results of which may be seen in many of the Appendices, the general conclusion of the Commission was, in fact, to confirm the main statements of the Reports of earlier investigating groups which had been disseminated through Prague.

The main travels undertaken by the Commission were as follows. Having unravelled the main threads of the situation in Peking from the 23rd. June to the 9th. July, it proceeded to Shenyang (Mukden), where it worked from the 12th. to the 25th. Accompanied by the members of the Reception Committee, it then passed across the Yalu River into North

Korea and held meetings in Pyongyang (subject to interruptions by air-raids) from July 28th. to 31st. Then returning north, the Commission spent two days at a rendezvous with the captured airmen before re-crossing the frontier into Northeast China on Aug. 6th. It should be recorded that the technical organisation of this expedition was faultless.

An earlier one, which took a shorter time, had been undertaken on the 15th. and 16th. July, when the Commission went by special plane, train, and jeep, via Chichihar and Laha to visit the localities in the Kan-Nan district which had been the scene of the dissemination of plague-infected rodents (see App. M). These places are located in Heilung-chiang province on the border of Inner Mongolia. Other official journeys were of a minor character.

It is important to say something regarding the difficulties of language necessarily attendant upon any enterprise such as that of the present Commission. Within the Commission itself seven languages were represented, but it was found that French was the one spoken and understood by the majority of the members, and this therefore became the working language. Russian, English, and Italian, when spoken, were at once translated into French. On the Chinese side, the fact that so many Chinese scientists speak excellent English or French was of great value to the work, but during meetings, for protocol reasons, they spoke in Chinese, interpreted immediately, and often independently, into French, Russian, and English. This was effected by Dr. YANG Shih-Ta and Mr. TING Chi-Ch'ien for French, Dr. CH'EN Shu for Russian, and Dr. YEN Jen-Ying for English. At a later stage of the work, Dr. WU Huan-Hsing rendered valuable literary and linguistic assistance. The Commission had further the advantage that one of its European members spoke and understood the Chinese language, which was of particular value during the interviewing of witnesses, and could also read and write Chinese, which facilitated the consultation of literature and the examination of documents. Another member was able to maintain direct English-Russian linguistic contact. In Korea conditions were even more complicated, for very few Chinese scientists understand Korean, but the Commission had there the services of a remarkable linguist, Dr. OK In Sup, who interpreted perfectly from Korean into French, English or Chinese at will. Other Korean-Chinese interpreters were also available. A parallel check was obtained by translation into one of the European languages through Chinese, and also simultaneously from Korean to Russian direct. Since frequent comparison of notes took place, it will be seen that there was not much likelihood of any mistake on points of substance. Lastly, the proceedings at some of the meetings were recorded by magnetophone for subsequent reference. For all these reasons, the Commission considers itself protected against

any criticisms that it did not succeed in apprehending the full mind of Chinese and Korean specialists and witnesses.

The names of the members of the Commission signed below bear appropriate indications as to the qualifications and fields of competence of the signatories. Their diverse experiences were pooled in laborious and extended discussions. Each contributed equally in all matters where a knowledge and understanding of the scientific method as such sufficed, and when the problem was remote from their own fields, the critical expositions of the better qualified members carried the conviction of the others. The present Report is thus a truly collective work.

Besides those things which the members of the Commission themselves saw and heard, and for which therefore they take the responsibility of witnesses, the Commission necessarily depended on Korean and Chinese documentation. Although there was no reason to doubt the competence and probity of the medical men and other scientists in China and Korea, the Commission left no precaution untaken. It never wearied in analysing the cases, and took the greatest pains to enter into direct contact with the original facts whenever this was at all possible. Its members held themselves continually on guard against political, ethical or emotional influences, and its work was done in an atmosphere of calm and scientific objectivity. Its final convictions naturally rested to some extent upon the reliability of the hundreds of witnesses interviewed and interrogated. Their testimonies were too simple, too concordant, and too independent, to be subject to doubt.

In the descriptions which will be found in the body of the Report it was obviously impossible to incorporate in every sentence the Korean or Chinese authority upon which the statement is based. Personal tests, examinations, interrogations, etc., carried out by the members of the Commission, have generally been mentioned in the text. In all cases, full details will be found in the relevant documents and commentaries indicated by the references to the Appendices.

A final Appendix (App. TT) gives biographical details of all the Chinese and Korean scientists whose names are mentioned in the documents here published.

Documentation

At the time when the members of the Commission first assembled, the only documents available to them were those which had been released by the Korean and Chinese Governments and disseminated in the western world from the secretariat of the World Peace Council at Prague or through the various Chinese official news agencies in the various countries.

The First Report of the Korean Medical Service (SIA/1) * dealt only with events of Jan. and Feb. 1952. The material contained in it was worked over again in the International Democratic Lawyers' Commission (Korea) Report (SIA/4), which added data on the appearance of plague cases in Korea, and of course the results of examination of eye-witnesses by international personnel.

The two most detailed reports were those of the Chinese Commission for Investigating the American Crime of Germ Warfare which carried out investigations both in Korea and in NE China (Manchuria) during the month of March. The main one of these was that of the sub-commission in Korea printed in Peking in April, given in full in NCNA/85 and abridged in SIA/13. The report of the sub-commission, in Northeast China (Manchuria) was similarly printed in Peking and abridged in SIA/3. This report is that which contained the fullest entomological information. Nothing of strictly scientific significance was added by the International Democratic Lawyers' version of the same material, again printed in Peking, and fully reproduced in SIA/8.

A special report by certain European scientists consulted by the Secretariat of the World Peace Council confirmed the entomological identifications by photographs, and appeared as SIA/2; it covered both Korean and NE Chinese data. A further special report by four Chinese scientists, again based on the same material, appeared as SIA/12.

Those who wish to examine the earlier reports would be well advised to study them in the above order. By the time that the members of the Lawyers' Commission returned to Europe (mid-

* The following document identifications will be used: Prague series, SIA/ ; New China News Agency, NCNA/ ; Documents furnished to the International Scientific Commission, in China, ISCC/ ; in Korea, ISCK/ .

April), a considerable amount of new duplicated and typescript material was ready for them to take with them, especially a series of ten important, but at that time only partially analysed, incidents, which, as they carried numbers 00001 to 00010, are termed the "Four-Zero Series".

The remaining material, while by no means lacking in scientific significance, was predominantly legal and personal. Eye-witness depositions, some of which concerned cases also described elsewhere (e.g. 00005), were collected in SIA/6 and 10. Statements of various American prisoners of war and agents were collected in SIA/7, while many papers were devoted to the elaborate statements of captured American pilots (SIA/14, 15, 16, 17, 18), and these themselves were photolithographically reproduced in a document published by the World Peace Council probably in May. A collection of relevant press excerpts on bacteriological warfare was brought together in SIA/5.

The Relevance of Japanese Bacterial Warfare in World War II

No investigation of allegations of bacterial warfare in East Asia could fail to take cognisance of the fact that it was undoubtedly employed by the Japanese against China during the second world war. The Commission was relatively well informed on this subject since one of its members had been the chief expert at the Khabarovsk trial, and another had been one of the very few western scientists in an official position in China during the course of the events themselves. In 1944 it had been part of his duty to report to his own government that although he had begun with an attitude of great scepticism, the material collected by the Chinese Surgeon-General's Office seemed to show clearly that the Japanese were, and had been, disseminating plague-infected fleas in several districts. They were thus able to bring about a considerable number of cases of bubonic plague in areas where it was normally not endemic, but where conditions for its spread were fairly favourable. As is generally known, under normal circumstances, bubonic plague is endemic only in certain sharply circumscribed areas (e.g. Fukien province) out of which it does not spread.

From the archives of the Chinese Ministry of Health one of the original reports dealing with the artificial induction of plague at Changtê in Hunan province by the Japanese in 1941 was laid before the Commission (App. K ISCC/1). This document is still today of considerable value and indeed historical interest. Official Chinese records give the number of hsien cities which were attacked in this way by the Japanese as eleven, 4 in Chekiang, 2 each in Hopei and Honan, and 1 each in Shansi, Hunan and Shantung. The total number of victims of artificially disseminated plague is now assessed by the Chinese as approximately 700 between 1940 and 1944.

The document reproduced below has, moreover, historical interest. It is known that the Chinese Surgeon-General at the time distributed ten copies among the Embassies in Chungking, and it may well be more than a coincidence that according to the well-known Merck Report of Jan. 1946, large-scale work in America on the methods of bacteriological warfare began in the very same year, 1941. The Commission was happy to have the opportunity, during its work in Korea, of meeting the distinguished

plague specialist who wrote the original memorandum from Changtê, and of hearing his views on the failure of the Kuomintang Government to follow up the evidence which was already in their hands by the end of the second world war (App. L). As is generally known, his conclusions were subsequently fully confirmed by the admissions of the accused at the Khabarovsk trial.

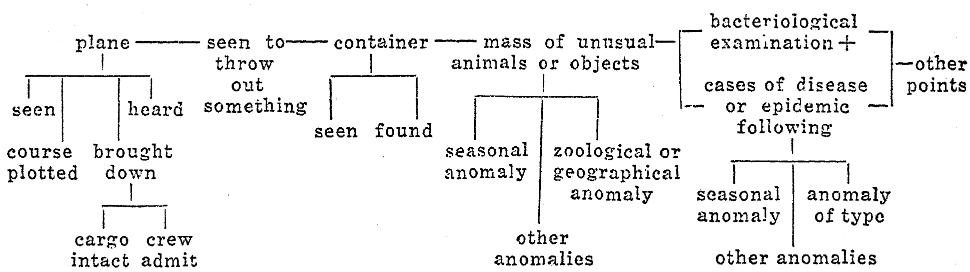
By the publication of the "Materials on the Trial of Former Servicemen of the Japanese Army charged with Manufacturing and Employing Bacteriological Weapons" (Moscow, 1950), a wealth of information about the practical work carried out under the direction of the Japanese bacteriologist Ishii Shiro (who was unfortunately not himself in the dock) was made available to the world. It was established beyond doubt that techniques had been employed for the mass-production of bacteria such as those of cholera, typhoid and plague, literally by hundreds of kilograms of the wet paste at a time. Techniques, quite simple in character, had also been used for the breeding of large numbers of rats and very large numbers of fleas, though in practice only the latter seem to have been disseminated. Moreover, the various witnesses were ready to give chapter and verse as to the dates upon which they had proceeded to various Japanese bases in China to superintend the methods of dissemination used. Abundant details were also forthcoming about the special secret detachments (such as the notorious "731") and their laboratories, pilot plants, and prisons in which Chinese and Russian patriots were made use of with perfect sangfroid as experimental animals. In the course of its work, as will be mentioned below (p. 42) the Commission had the opportunity of examining some of the few remaining specimens of the earthenware "bombs" which were manufactured for Ishii in a special factory at Harbin.

It would seem that the Japanese militarists never abandoned their visions of world-conquest by the aid of biological weapons in general and the dissemination of insect weapons in particular. Before they departed from Dairen they systematically tore out from all volumes of journals in the university and departmental libraries articles which had any connection with bacterial warfare. It should not be forgotten that before the allegations of bacterial warfare in Korea and NE China (Manchuria) began to be made in the early months of 1952, newspaper items had reported two successive visits of Ishii Shiro to South Korea, and he was there again in March. Whether the occupation authorities in Japan had fostered his activities, and whether the American Far Eastern Command was engaged in making use of methods essentially Japanese, were questions which could hardly have been absent from the minds of members of the Commission.

Incident Analysis Adopted by the Commission

On account of its very nature, the use of biological weapons is an act exceptionally difficult to prove. Perfect proof might require, for example, that an airplane be forced down with its biological cargo intact and its crew prepared to admit their proceedings forthwith. Obviously this would be a very unlikely occurrence for many reasons. It is therefore necessary to envisage a manner of grouping events into a coherent pattern so that they can throw light upon each other and perhaps build up a circumstantial case. A first necessity, therefore, for the thought and work of the Commission was some kind of scheme which could serve as a framework for the facts which it would have to study in each particular investigation.

The simplest scheme, in which, under ideal conditions, every component would be present and positive, was the following:—



Naturally this complete pattern will rarely or never be encountered. There are, nevertheless, cases which come near enough to it to be decisive. In this way it is possible to reconstruct the activities of those who have utilised such methods, and to elucidate the effects which have been produced by them. The Commission paid particular attention to those assemblies of facts which attained most nearly the demonstrative character of the ideal pattern. When the general complex of facts resulting from the confrontation of numerous patterns is examined, the whole situation becomes clear, (cf. p. 55 below).

Entomological Data of the Prague Documents*

One of the first tasks which presented itself to the Commission when it began its work in Peking was the systematic examination of the scientific material on which the Prague documents had been based, and one of the first aspects of this work was the tabulation of the entomological evidence in conjunction with the Chinese scientists of Academia Sinica and other learned bodies who had been responsible for the identifications. The opinion of the Commission was soon formed that there could be no doubts whatever as to their high competence (App. B). They are, moreover, provided with very extensive library facilities including a rapid loan system between institutes, and the various collections of insects are maintained in excellent order. The only real difficulty, which remained insuperable, was the fact that even after the work of half a century, the systematic classification of many groups of insects in the Chinese subcontinent remains imperfectly known. It was therefore impossible to assert that all new introductions could be definitely recognised as such; and the Commission had to be content with the fact that in certain cases certain insect species had at least never before been recorded from areas in which they now appeared in great numbers.

The species identified from specimens sent to the Chinese experts as representatives of unusual multitudes of insects found after the passage of American planes, are given in Table (App. H). They include nine species of Diptera (six species of flies and three of mosquitoes and midges), one of Plecoptera, one of Collembola, one of Siphonaptera, and three of Orthoptera, as well as two spiders (Arachnida). In all, eighteen species including a beetle to be mentioned below.

One of the original impressions which the documentation (e.g. SIA/4) had given in Europe was that certain arthropods had been found which belonged, not only to species, but to genera, never known before in the relevant regions of continental Asia. This was not confirmed. Nevertheless, in three cases there were phenomena clearly anomalous in this respect. The species of *Hylemyia* (anthomyiid fly) identified repeatedly from numerous swarms collected, proved definitely not the same as any one of the four species common in Northeast China, nor with any one of the fifteen species previously recorded from all parts of China.

* Documents published in Prague, "Palais SIA."

The genus, however, has some 600 species, counting all parts of the world, and the true faunal areas of all of them are not yet perfectly known (App. H). Similarly, the sun-flies found (*Helomyza modesta* Meigen) were certainly not identical with the single species of this genus previously recorded from China (App. H). Exactly the same observation applies to the midge *Orthocladius*. These zoological and geographical discrepancies must be allotted due weight in the consideration of all the evidence.

In any case, the anomalies proved to be much more extraordinary on the oecological than on the zoological-geographical side. While the various species might or might not be strange to the region, it was certainly exceedingly strange to find them appearing in very large populations during the first three months of the year, when the snow is still on the ground in North and Northeast China and in Korea. The Commission found no difficulty in substantiating that these masses had been seen (and destroyed as quickly as possible) by very many ordinary men and women in all walks of life. Of the eighteen species so far referred to, no less than twelve exhibited marked seasonal anomalies of appearance. In other words they appeared in mass with a precocity varying from 6—14 weeks earlier than the time of year at which, according to the personal experience and published works of competent entomologists, they ought normally to be expected to appear. The average shift was one of 9 weeks; more than two months (App. H).

Here several points of interest arise. The collection of many tens of thousands of flies of approximately the same size as house-flies can easily be imagined, but the size of the spring-tail (*Isotoma negishina* Börner) is so small (only 2 mm. in length) that immense numbers in high density must have been present to have attracted any attention at all (App. H). Wherever possible, concrete figures for assessed densities have been given in a Table (App. G). An observation of importance made by one of the Chinese entomologists in SIA/12 was that certain masses of *Hylemyia* appearing when the temperature was -10°C. contained a high proportion of individuals ready to lay eggs, thus still further deepening the mystery of their origin. Similarly striking was the case of the field-cricket *Gryllus testaceus,* the life-history of which happened to have been the subject of an elaborate paper written in Peking in 1951 (App. G). Thousands of adults of this species appeared in March near K'uan-Tien in Liaotung province, NE China (Manchuria), adjoining Korea, i.e. at a time when even in Peking, which has a warmer temperature than NE China, there should be present no individuals except those in the egg stage.

Now it may be granted that isolated and sporadic instances of the appearance of swarms of various kinds of insects in winter are to be found

in entomological literature. But it is hardly conceivable that such phenomena could occur for so many species at once if its causes were purely natural. The Commission ascertained that the meteorological conditions pertaining in the past winter in NE China (Manchuria) and Korea were strictly normal (App. H). It was therefore not at all surprising that the Chinese and the Koreans associated the unusual phenomena with the passage of American planes which on many occasions were seen by eye-witnesses to throw down non-explosive objects whence insects emerged. The Commission interviewed such eye-witnesses (App. W, Y & BB), and assured itself of their good faith and rational credibility. As we shall see (p. 37 below) containers of types both banal and highly peculiar were found and studied. Unfortunately in some of the documentation which reached Europe (such as the Four-Zero Series) the essential statements of the passage of the planes beforehand were not included, but the Commission was able to clear up this important point (App. G).

Another argument would admit that there had indeed been a shift of the times of appearance of a considerable number of species of insects, but would urge that even if this could not have been due to abnormal meteorological conditions, some other natural factor had been at work, shifting systematically all the apparitions backwards by the same amount. A test of this was fortunately very easy. It was only necessary to arrange the various species in the order of their normal appearance, and then to plot on the same graph the order of their abnormal appearance. If a uniformly-acting natural factor had been at work, the two curves or lines should run parallel, but a glance at Fig. 1. (App. H) is sufficient to show that they do not. The order of abnormal appearances is so haphazard as to indicate the intervention of an artificial factor.

One argument which had a certain success in various countries before the Commission began its work was that napalm bombing had notoriously been going on, and that this might well have led to intense and localised heating of the earth. Such an effect might have disorganised the normal life-cycles of various kinds of insects so as to lead to their appearance several weeks or even months before their proper time. The Commission therefore noted with interest the fact that many dozens of accounts of masses of insects including 33 principal incidents (some of which are given in Table, (App. G) originated from places in NE China, a region in which there has, of course, been no napalm bombing.

All the foregoing remarks apply to the species of insects mentioned in the SIA and parallel documents. A few species mentioned there by common names, such as "ants" and "horse-flies", could not be confirmed by the Chinese entomologists, and there may well have been some con-

fusion due to terms used by non-scientific eye-witnesses. At a later stage the Commission examined new evidence concerning a coleopteron (beetle), *Ptinus,* (App. AA) ; this will be dealt with it in its place. Both in this and other cases of infected insects, the material assembled in the Appendices is available for the study of the connections between the vectors and the outbreaks of disease. Relevant also here is the question of the measures taken in China and Korea to control insect populations (see App. PP), and that of the occurrence of pathogens on random samples of normal insects (App. D & E).

Medical Notes on the Insects Disseminated

The reader may encounter in the following paragraphs certain insects and spiders the names of which are likely to be unfamiliar to non-specialists. The following lines are intended to supply brief descriptions of them, and they are arranged in correspondence with the order adopted in Appendix.

The insect most frequently found to be disseminated is the anthomyiid fly, *Hylemyia* sp. Flies of this genus are particularly common in North America, and there are in all more than 500 species, some of which frequent human habitations. Since they breed in human excrement they are naturally important as mechanical vectors of intestinal diseases. Many of the species pass the winter underground in the pupal stage, and in general their appearance in large numbers does not occur earlier than the month of May. Under natural conditions these flies can be infected by various bacteria pathogenic to plants (cf. p. 23 below).

Helomyza sp. (family Helomyzidae), the sun-fly, is an insect which frequents dungheaps. There are several dozen species most of which live on the excrement of man, bats, small mammals and birds; not only in the larval but also in the adult stages. Some species of these flies frequent human habitations, where they soil food and become the mechanical vectors of any human disease due to pathogenic bacteria.

The house-flies, *Musca domestica* and its southern form *Musca vicina*, live invariably with man, and are well recognised as carriers of the agents of his diseases. More than sixty different species of pathogenic bacteria have been found on them.

The large house-flies, or stable-flies, *Muscina stabulans*, are also recognised as insects associated with man, and mechanical vectors of human diseases.

All the above belong to the Diptera. The Plecoptera have been represented by *Nemoura* sp., one of the stone-flies. These multiply in streams and running water, their larvae feeding on the micro-organisms in the water. The adults do not like to stray far from this environment of their growth. Contact with man can occur through water and plants.

The Collembola, primitive wingless insects, have been represented by *Isotoma* sp. These develop in decomposing plant material and damp soils

rich in humus, and in the roots of vegetables. Some species develop on the surface of standing water.

In natural conditions, it has been proved that *Pulex irritans,* the flea parasitic on man, is capable of causing serious outbreaks of plague, (Blanc and Balthazar). It will later be seen that this vector has been utilised in bacteriological warfare.

The beetle *Ptinus fur* (Coleoptera) belongs to a genus comprising some 35 to 40 species most of which have the same habits, and some of which live in the neighbourhood of man. The species in question is most frequently found in human habitations, storehouses, stables, lofts and mills, libraries, and factories. It lives on husked grain, cereals, cotton-seeds, stale bread or biscuits, flour, straw, furs, carpets, leather, etc. Among these things it lays its eggs. The process of metamorphosis lasts from 3 to 4 months, so that at least three generations can be produced in one year. The adult beetles can live for five years. They are to be met with in Europe, Asia, and North America, so that the species is widespread. Virulent anthrax bacilli have been isolated from *Ptinus* in the natural state (App. AA & BB).

Among the spiders, the representatives are *Lycosa* sp. and *Tarentula* sp. of the family Lycosidae. They are carnivorous, feeding on mosquitoes, flies, ants, and other species among which there may be some which are vectors of human diseases. When such a spider attacks a man, the pathological phenomena seen are provoked not only by the venom of the bite, but also by the fact that pathogenic bacteria may be injected at the same time. The excreta of these spiders may also contain pathogenic bacteria. Their length of life is considerable, attaining several years. The adults are capable of living for two years without food, and several months without water; they can also withstand light frosts.

In the scientific literature there are descriptions of methods for the artificial production of insects and arachnids on a large scale. The most complete information on this subject will be found in a collective work prepared by American entomologists and entitled "Culture Methods for Invertebrate Animals" (New York, 1937).

As can be seen from the above commentary, some of the insects disseminated are known vectors of diseases, while others do not figure in the text-books as having anything to do with such transmissions. Thus the flies *Hylemyia* and *Helomyza* frequent human habitations from time to time, while other insects, such as the Collembolan *Isotoma* sp., have only remote contacts with man. It would therefore seem unlikely at first sight that such arthropods could have any importance in the transmission of human diseases. However, one must take into consideration not only the

great latitude of the so-called specificity of vectors, but also certain aspects of the vector-host relationship not yet clarified.

Thus the connection of man with the fowl mite *Dermanyssus gallinae* is possible only in peculiar and narrowly-defined conditions. Before 1944 nothing was known of the important part played by this ecto-parasite in the transmission and conservation of the virus of encephalitis. Before then it would have seemed absurd if anyone had made use of *Dermanyssus* to provoke artificially an epidemic of encephalitis.

It can not be accepted as a general rule that those species which are in intimate contact with man are necessarily more effective disease vectors than wild species. Thus among many examples one may take that of the mosquitoes *Aedes scapularis* and *Haemagogus spegazzinii*. Under laboratory conditions these species transmit yellow fever. Now the first of these is very domestic and frequents human habitations located in forest regions, while the second one never enters them. Yet the human commensal has no important role in the transmission of yellow fever, while the wild species is well known as a vector.

As for the case of *Isotoma*, for example, various hypotheses may be formed, so long as one does not lose sight of the fact that they are only speculations about experiments of which we know nothing. For example:

a) *Isotoma* ⇛ infection of lower mammal ⇛ ecto-parasites (fleas, mites, etc.) ⇛ infection of man.

b) *Isotoma* ⇛ Contamination of food or water ⇛ infection of man.

c) *Isotoma,* multiplication of the pathogen in, ⇛ *Isotoma,* congenital disease ⇛ infection of lower mammal ⇛ ecto-parasites ⇛ infection of man.

d) *Isotoma* ⇛ infection of plants.

Many other hypotheses would also be plausible.

The same kind of suppositions apply also to the stonefly, *Nemoura*, but here there are probably yet other possibilities, hard to state precisely at present. There is no difficulty in understanding the role of the semi-domestic flies as vectors, especially when artificial laboratory conditions permit an augmentation of the percentage of infection, and an increased virulence of the pathogenic agent.

One further important point is worth emphasising. A single species can be semi-wild in one region and domesticated in another. As an example, one may cite the Anopheline mosquitoes of the genus *Kerteszia* which have no domestic habits north of the 24th degree of latitude in South America, and therefore play no part in the transmission of malaria.

But south of that line, on the contrary, they become very domestic, and consequently attain importance in the transmission of the disease.

Lastly, it is well known that prolonged researches were necessary before it became possible to establish definitely the role of arthropods as vectors in parasitic and bacterial diseases, such as the anopheline mosquitoes for malaria, fleas for plague, lice and ticks for Rickettsias, and so on. The part which arthropods play in the transmission of disease agents is something which requires continued study. Little known vectors may well have been employed in the hope that the methods of control of these unusual species of insects had not been worked out. Thus with regard to the methods of bacteriological warfare it can be seen that the artificial establishment of new biological inter-relations is quite possible, and though the researches required to elucidate them may be arduous, they are not likely to be unsuccessful.

Phytopathological Data

Several references were made in the earlier literature to the dropping of packets of plant material from American airplanes. They were usually seen by the eye-witnesses to burst at about 1000 ft. and scatter the leaves or other parts of plants over a wide area. Incidents of this kind occurred at Chong-Ju in Korea on 20th March (NCNA/85, p.9; SIA/13, p.4) and at more than ten other localities in Northeast China and North Korea. In one case the descent of the material was seen personally by a British war correspondent (SIA/6, p.2). Members of the Commission were able to discuss the botanical and mycological identifications with Chinese phytopathologists and botanists of international repute (App. Ja).

It was established that the stalks and pods of soya-beans were infected with purple spot fungus, *Cercospora sojini* Hara, (syn. *Cercosporina kikuchii* Matsumoto and Tomoyasu). This fungus is a plant pathogen which has been reported from Korea and China, and which could cause serious damage and loss to soya-bean crops. As in the other cases here discussed, the pathogenic organisms were found inside the tissues of the plant material, showing that it was thoroughly and not merely superficially infected.

Among the fragments of leaves some were infected with anthracnose *(Glomerella,* sp., the asexual stage of which is called *Colletotrichum).* The organism found has a wide host range, attacking apple-trees, pear-trees, and cotton-plants, as experimental inoculation tests demonstrated. Ordinary cotton anthracnose (*Glomerella gossypii* (South) Edg.) only attacks cotton and related plants, while the apple bitter-rot fungus (*Glomerella cingulata* (Stoneman), S. & S.), though attacking more than thirty host plants, does not attack cotton. Both these have been reported from China. The fungus found, however, has morphological differences from them, as well as a much wider host range.

A third case of dissemination of a plant disease occurred as late as July, after the Commission had begun its work, near Hsiu-Yen in the south of Liaotung province. Peach-leaves, (not its natural host) were found to be infected with *Macrophoma kuwatsukai* Hara, the fungus causing apple and pear fruit rot (ring-spot) and also canker and twig blight of those trees. The fungus isolated proved to be highly infectious.

In the above three cases, precise eye-witness accounts of the dropping of the packets of plant material were available.

A further incident in this phytopathological warfare which came to the attention of the Commission, was the appearance of scattered corn (maize) grains (kernels) after one of the constant American air intrusions over Liaotung province in NE China (Manchuria), at the village of Sun-Chia-Pao-Tzu near Antung. These grains were found to be infected with a species of *Thecaphora* similar to, but not identical with, *Thecaphora deformans,* which is known as a pathogen of legumes in America and Europe. The plant pathogen here found had never previously been reported from China.

Although the leaves were sometimes in a fragmentary state, there was only one consignment (the anthracnose case) in which they could not be fully identified. In the first incident the material was *Glycina max* (*G. hispida*), in the third *Prunus persica,* and in the fourth *Zea mays.* Other consignments frequently consisted of *Quercus* sp. (oaks) and *Sorghum vulgare* (kaoliang). Among them two are of particular interest (App. Jb). At Dai-Tek San in North Korea a mass of leaves was dropped which were identified as those of the deciduous oak *Quercus aliena,* Bl. var. *rubripes,* Nakai, a tree the distribution of which is strictly limited to regions south of the 38th parallel of latitude. At Hai-Loon hsien in NE China another mass of leaves was dropped on May 3rd, which were identified as those of *Lindera glauca* Bl., a tree only found in South Korea and quite unknown in Northeast China.

Allusion should be made to the possible use of insects as vectors of plant as well as human diseases. It is well known, for example, that the anthomyiid fly *Hylemyia* spp. (cf. p. 18 above) carries fire-blight of pear and apple (*Erwinia amylovora*), corn (maize) wilt (*Phytomonas stewartii*), and soft rot of vegetables (*Erwinia carotovora*)—three bacterial diseases—together with the fungal "black-leg" of cabbage (*Phoma lingam*). It is also well known that *Muscina stabulans* carries fire-blight of pear and apple. Chinese phytopathologists have isolated strains of bacteria from the insects (and leaves) disseminated, and research is proceeding.

In general it may therefore be said that the dissemination of plant diseases has certainly played a part in the biological warfare which has been carried on in Korea and Northeast China (Manchuria).

Incidents in Korea (plague)

As has already been observed, the classical method of bacteriological warfare involving plague, that adopted by the Japanese during the second world war, consists in delivering, whether by container or spray, large numbers of fleas infected with plague bacteria. Since the beginning of 1952 numerous isolated foci of plague have appeared in North Korea, always associated with the sudden appearance of numbers of fleas and with the previous passage of American planes. Seven of these incidents, the earliest dating from 11th Feb., were reported in SIA/1, and in six of them the presence of the plague bacteria in the fleas was demonstrated. Document SIA/4 added the statement that after a delivery of fleas to the neighbourhood of An-Ju on the 18th Feb., fleas which were shown bacteriologically to contain *Pasteurella pestis*, a plague epidemic broke out at Bal-Nam-Ri in that district on the 25th. Out of a population of 600 in the village, 50 went down with plague and 36 died (App. G).

According to the best information which the Commission was able to obtain, for the past five centuries there has been no plague in Korea. The nearest endemic centres are three hundred miles away in NE China (Manchuria) and a thousand miles to the south in Fukien. Moreover, the month of February would be no less than three months too early for the normal appearance of human plague cases in this climate. Above all, the fleas appearing were not the rat fleas which more usually carry plague bacteria in a state of nature, but human fleas (*Pulex irritans*). It was these which were used by the Japanese during the second world war, as we know from identifications on the Chinese side (App. L) and from other indications (App. S).

While in Korea the Commission was invited to study two special cases (App. R & T). In the first of these, at Kang-Sou towards the end of March, a farmer went to a jar near his well one morning after a plane had circled over his village the previous night. He found that numerous fleas were floating on the surface of the water in the jar. He was probably bitten by other fleas of the same sending, for he died of bubonic plague a few days later, the diagnosis being abundantly confirmed by pathological and bacteriological tests, carried out by Korean and Chinese experts. The fleas also were demonstrated to be infected with plague bacteria. Members of the Commission inspected the cultures of micro-

organisms isolated from the body of the patient by the above-mentioned specialists, and convinced themselves that these cultures were really of *Pasteurella pestis:* Pathological and histological preparations were also examined. Prompt sanitary measures at Kang-Sou had prevented further cases.

In the second of the studies, two lieutenants of the Chinese Volunteer Forces in Korea, found a very dense mass of fleas on a bare hillside near Hoi-Yang. The zoning was so distributed as to indicate that they had been delivered by a container which came down rather slowly in a NNE direction, but no trace of any container could be found. Somewhat astonished at the density of the population, which darkened the ground and blackened their trousers, the two young men, who were afterwards questioned by the Commission personally, returned to their quarters and brought reinforcements which destroyed the fleas with a fire of petrol and pine branches. In this case the soldiers were protected in a number of ways (App. U) and their prompt counter-measures took effect before any appreciable number of the fleas could find their way to routes of transit frequented by human beings. Tests carried out by the Korean-Chinese services showed that these fleas were infected with plague bacteria, and that they were human fleas.

The fact that they were fleas (*P. irritans*) parasitic on man must be emphasised. According to what is known of the oecology of this insect, it would be impossible to find large numbers away from the houses of man. What, then, is to be said of the occurrence of a number of these insects estimated at many tens of thousands, at one time, on bare waste land remote from any human habitation? Such a witches' sabbath was certainly not called together by any natural means. More relevant was the plane which members of the CPVF billeted in the neighbourhood had heard circling over the place at about 4 a.m. on the day of the discovery.

Analysis shows that in these circumstances some of the normal links in the epidemiological chain of plague, in which *Pulex irritans* participates, are missing. Normally the epizootic disease manifests itself first among rodents, and this is followed by an outbreak of human cases, from which *P. irritans* is secondarily infected. Only then is this parasite of man capable of giving rise to further cases.

In the light of all these and other similar facts, the Commission had no option but to conclude that the American air force was employing in Korea methods very similar to, if not exactly identical with, those employed to spread plague by the Japanese during the second world war.

During the discussions of these cases at Pyongyang the Commission had the help of one of the foremost Chinese experts on plague, the author,

indeed, of the 1941 report (App. K). He gave evidence to the effect that he had urged the Kuomintang government to make known to the world the facts concerning Japanese bacterial warfare, but without success, partly, he thought, as the result of American dissuasion (App. L). He also drew attention to the high virulency of the strains of plague bacteria now being used in Korea.

The delivery of plague-infected fleas is of course not the only way in which it might be hoped to induce an epidemic. Other methods can be used and we shall now see that this has indeed been done.

The Kan-Nan Incident (plague)

Another case with a relatively complete sequence of component elements which the Commission was invited to consider in great detail was one involving the sudden appearance of a population of voles infected with, and suffering from, plague. On the morning of the 5th. April, 1952, the countryfolk of four villages situated within the area administered from the town of Kan-Nan (Kan-Nan hsien), awoke to find themselves surrounded by large numbers of a rat-like animal (App. M). This town lies on the western border of the province of Heilungchiang in NE China (Manchuria), and its district is thus just on the edge of Inner Mongolia.

During the previous night many of the villagers had heard a plane pass overhead, and information provided by the Chinese Air Observer Corps shows that after having crossed the Yalu River just before 10 p.m., it was over Kan-Nan district about 11:30; it then retraced its course as if its mission had been accomplished (App. M). It was identified by the Corps as an American F-82 double-fuselage night-fighter plane. In the morning, the villagers found many of the voles dying or dead in their houses and courtyards, on their roofs, and even on their beds, while others were scattered around the outskirts of the settlements. The total number collected and destroyed in and near the inhabited places of an area measuring roughly 3 $\times$ 9 miles was 717 (App. M). There was an anomaly of season, for small rodents do not usually begin to show themselves in this region until a month later, and then in nothing approaching such numbers (App. M). The location was also anomalous, for voles are not frequenters of human settlements.

The species concerned also seemed to be regionally anomalous. It had never before been seen by the local people. It was possible to identify it as belonging to the genus *Microtus*, and morphologically similar to *Microtus* (*Stenocranius*) *gregalis* (*Pallas*). This species had previously been reported by Tokuda (1941) from parts of Northeast China (Manchuria) northwest of Kan-Nan, and by others from points still more to the west. Further taxonomic study by Chinese scientists is in progress (App. O.P). Moreover, this genus is not among those three which are normally carriers of plague (*Pasteurella pestis*) in those parts of Northeast China where the disease is endemic (App. M). Analysis of the evidence by the Commission, both at Shenyang

(Mukden) and at the villages, showed that a certain role in concentrating the animals must have been played by the cats of the farmers, but it also became clear that the members of the intrusive species were uniformly diseased or dying before the cats found them. Some died in circumstances which excluded the action of cats.

The Kan-Nan area has never known any form of plague so far as records are available, and reasons more than adequate were presented to show that a migration of the voles from the nearest endemic areas must be regarded, in view of the distances and obstacles involved, as highly unlikely (App. M). Furthermore the season was at least a month too early for the normal occurrence of epizootics of plague among rodents in the endemic areas (App. M). Only one individual was preserved sufficiently for bacteriological test, but the evidence of virulent infection with *P. pestis* obtained from this specimen, together with the eye-witness accounts mentioned above, pointed unmistakably to a collection of animals in the full grip of the plague (App. M & N). This evidence was confirmed in personal experiments carried out by those members of the Commission competent to do so, in collaboration with the Chinese scientists, and demonstrated to the whole Commission in the Bacteriological Laboratories of the National Medical College at Mukden.

The principal gap in the chain of evidence consists in the fact that no container or "bomb" of any kind was discovered. However, in view of the fact that in Jan. 1952 there was described in a Japanese journal (*Mainichi*) a container and parachute made of strong paper in such a manner that it would burn away, leaving no trace, after depositing its cargo of infected rats (App. Q) ; this missing link can hardly be considered sufficient to render nugatory the mass of circumstantial evidence already outlined. Other Japanese press reports (*Kowa Shimbun*, Aug. 1952) revealed the existence of a breeding Institute directed by Ojawa, a former assistant of Ishii Shiro, which produces a large number of rodents, (App. P).

It only remains to add that the Commission heard evidence at Shenyang (Mukden) from ten farmers, who, with others, were visited also individually in their homes. It also heard evidence from the epidemiologist who took charge of the local sanitation arrangements after the incident, from the bacteriologists who investigated and isolated the plague bacteria, and from the zoologist responsible for the specialised study of the rodents. The Commission considers that the countryfolk owed their escape from plague in this case to the sanitary precautions which they took from the moment of first discovery of the unusual rodents, and to the remarkable promptitude with which they destroyed the whole popula-

tion of cats and dogs at noon on the same day. Among the precautions taken was a very effective method in common use in NE China for destroying fleas in human habitations; a thin layer of dry hay and straw is thrown over the earthen floors and k'angs, after all household goods have been removed, and then set on fire. For these reasons plague-infected fleas were unable to transmit the pathogenic agents to the human beings.

In the opinion of the Commission, therefore, there remains no doubt that a large number of voles suffering from plague were delivered to the district of Kan-Nan during the night of the 4th/5th April, 1952, by the aircraft which the villagers heard. This was identified as an American F-82 double-fuselage night-fighter.

The K'uan-Tien Incident (anthrax)

The Commission studied in detail a case which involved the abnormal and simultaneous appearance of anthomyiid flies and spiders (App. V). On the 12th March, 1952, inhabitants of the town of K'uan-Tien, which lies in the southeastern part of Liaotung province near the Yalu River, saw eight American fighter planes pass over the city about half-an-hour after noon. They recognised them without difficulty for such intrusions were a common, almost daily, occurrence. The Chinese Air Observer Corps identified them as F-86 planes and spotted their courses. From one of them there was distinctly seen to drop a bright cylindrical object. Immediately afterwards, and during the following days, the people of the town, including school-boys, organised searches in the region beyond the east gate where the object appeared to have fallen, and collected many anthomyiid flies (*Hylemyia*, sp.) and spiders (*Tarentula*, sp.).

Nine days after the original incident, one of the schoolboys was so fortunate as to discover fragments of a container in and around a shallow crater at the point of impact of the object (App. V & W). The location was a maize field constituted by a small island surrounded by the beds of rivers dry at this time of year. The largest "bomb" fragment was of metal, but the most numerous were of a thin porous calcareous substance the nature of which was not immediately obvious. This was later identified and will be discussed separately (p. 42). The site of the incident was visited on the following day by two well-qualified entomologists, who had already searched in the immediate neighbourhood four days earlier; they collected a further supply of flies, and carefully assembled as many container-fragments as possible, melting the snow with the help of hot water.

The presence of snow, at least in drifts between the furrows explains how it was possible for the insects (sluggish at the low environmental temperature) to remain for more than a week in the close neighbourhood of the point of impact. It also explains the similar continued presence of considerable numbers of fowl feathers (also delivered at the same time) in the same zone. The insects and arachnids showed an anomaly of seasonal appearance (see p. 15-16 above) and the former also a regional anomaly as to zoological species (see p. 14 above).

Competent bacteriological examination by the Chinese demonstrated the presence of the pathogenic organism causing anthrax (*Bacillus anthracis*) both on insects, spiders and feathers (App. V). The occur-

rence of this in or on the arthropods must be considered a highly extraordinary phenomenon. While its occurrence on the fowl feathers is not quite so remarkable, bacteriological examination by the Chinese services of control specimens of feathers collected at random in N. China and NE China (Manchuria) yielded negative results (App. F). Moreover, the feathers may perhaps have been simply packing to ensure the safe passage of the insects, though it must be remembered that in other cases anthrax-infected feathers have been delivered alone. No cases of anthrax in or around the town were reported as a result of this intervention.

In view of the above facts the Commission had no option but to conclude that insects and spiders carrying anthrax had been delivered by means of at least one container of special type from at least one American plane in the neighbourhood of this small town in Liaotung province on March 12th.

Incidents in Liaotung and Liaohsi (respiratory anthrax)

The Commission gave exhaustive study to a group of cases in which American planes coming from across the Yalu River and returning thither were actually seen to drop objects of various kinds (App. AA). Though no containers could be found at the presumed points of impact when local eye-witnesses immediately went to search for them, other things were found, notably large numbers of beetles of the species *Ptinus fur* (normally a pest of stored grain and other dry stuffs), or alternatively masses of downy feathers of fowls. In some cases large numbers of the house-fly *Musca vicina* unexpectedly appeared, with the anomaly of season so often noted, snow being still on the ground. Though the beetle was not seasonally anomalous, its appearance in the open air and in daylight in great numbers was oecologically extraordinary. All three of these biological objects were found by the Chinese bacteriologists to be contaminated with anthrax bacilli. And the strains of bacilli isolated, in spite of the diversity of the objects, all had exactly the same behaviour in fermentation tests, —an unusual and suspicious circumstance.

Thorough examination of 24 eye-witnesses was carried out, some of whom had been among those who saw the objects descending from the planes. Spotting records from the Chinese Air Observer Corps were available in all cases (App. AA) and this information showed that the intruding planes were in general F-86 fighters, with the exception of a B-26 bomber on one occasion. In one case several people saw an object like a large red thermos flask thrown down, which seemed to burst with an explosive puff and a disagreeable smell like burning skin or horn when about 30 ft. from the ground (cf. the paragraph on Containers). In another case valuable testimony, admitting the absence of any material container at the presumed point of impact, described the slow dispersion by the wind of a large quantity of feathers from just that point, with the formation of a triangular area slowly extending and broadening. In this instance the description of the container was such as to recall strongly the self-destroying "egg-shell" type used at K'uan-Tien, (App. V and p. 42 below).

The evidence concerning aircraft, containers, biological objects appearing, and bacteriological tests, was now amplified, for a number of localities

in the provinces of Liaotung and Liaohsi, by concrete and well-analysed data concerning fatal human cases of respiratory anthrax and haemorrhagic anthrax meningitis (App. AA). Five of these were examined, that of a railwayman, a tricycle-rickshaw driver, a housewife, a school-teacher, and a farmer. All of these fell sick of a disease which ran a similar rapid course, and all of them presented the same picture to the pathologists on autopsy and subsequent histological analysis. The Commission satisfied itself that none of the cases had the customary occupational history connected with anthrax. The beetles appear to have been responsible for two of the deaths, while the flies and the feathers would have accounted for another two. The Commission was fully satisfied with the diagnoses made and the proofs demonstrated by Chinese scientific colleagues. Furthermore, the examination of witnesses brought out (App. BB) what was missing from the document itself (App. AA), namely that four out of the five victims had not only collected the insects and feathers in the general course of such organised hunts, but were known to have dispensed with the recognised precautions followed by most people; that is to say, he or she had failed to protect the respiratory passages by a mask, or had handled the biological objects without gloves or forceps. Under the dissecting microscope it was clear that the beetle *Ptinus* would be well adapted for disseminating anthrax by this route, for it has an abundance of brittle chitinous spines on its elytra which could be inhaled, a fact which the document apparently overlooked.

It is not to be supposed that these were the only deaths caused by the anthrax-infected objects; the five cases, with their precise pathological analysis, were presented as samples. Nor can the five cases be placed in their proper setting unless the full rarity of this kind of disease in the region previously, is clearly understood. Statistical evidence is presented (App. AA & BB) which shows that not only was the classical cutaneous or pustular anthrax exceedingly rare in NE China in recent times, but respiratory anthrax leading to haemorrhagic meningitis was completely unknown.

It is well known that the literature contains proposals for the use of anthrax bacilli in bacteriological warfare. Although, under natural conditions, transmission from man to man occurs only rarely, so that a spontaneous epidemic could not easily be set on foot, the bacillus has the "advantages" of a wide host range, a high infectivity if virulent, and an extreme resistance to environmental conditions so that it is capable of poisoning a locality for a long time. To these must be added the very insidious character of the disease when the infection occurs by the respiratory route, for all the victims here mentioned remained comparatively normal until they suddenly collapsed, after which death ensued in 48 hrs. or less.

Anthrax infection by the respiratory route is significant in connection with the work on bacteriological warfare carried out in the United States. Researches from Camp Detrick, published in 1946 and 1947 (see App. AA & II), show that it has been possible to obtain new strains of anthrax bacilli cultured on synthetic media which not only possessed unusually high virulence, but which are especially adapted to the respiratory route of infection.

On the basis of the evidence presented, and on their own searching and prolonged interrogation of a considerable number of witnesses, both medical and lay, the Commission was compelled to conclude that the delivery of various biological objects contaminated with anthrax bacilli to many places in the two Chinese provinces had taken place, and that this had given rise to a number of cases of a mortal infection hitherto unknown in the region, namely pulmonary anthrax and ensuing haemorrhagic meningitis. Eye-witness statements impossible to doubt indicated American airplanes as the vehicles of delivery of the infected objects.

The Dai-Dong Incident (cholera)

One of the incidents to which the Commission was invited by the (North) Korean Minister of Health to devote detailed attention concerned certain fatal cases of cholera illustrative of those which have been occurring in rural areas since May, 1952 (App. CC). Early in the morning after a night (16th May) during which a plane had been heard circling round for an hour or more as if its pilot were trying to find something, a country girl picking herbs on the hillsides found a straw package containing a certain kind of clam. She took some of the clams home and she and her husband made a meal of them raw; on the evening of the same day both fell suddenly ill and by the evening of the following day both were dead. Medical evidence showed that the cause of death was cholera (App. CC). Further packages of clams were found on the hillsides by the local Home Guard, and bacteriological examination by the Korean and Chinese specialists proved that the clams were heavily infected with the cholera vibrio (App. CC).

The whole sequence of events becomes more and more extraordinary the more closely it is examined. In the first place, the appearance of marine molluscs (*Meretrix meretrix*), contaminated in this way, on a hill in the middle of the countryside, can only be regarded as a highly unnatural phenomenon. The human fatalities, moreover, were epidemiologically very abnormal. Evidence presented convinced the Commission that cholera has never been an endemic disease in Korea; for while there have been a number of outbreaks during the past forty years it was always possible to trace them to a maritime point of entry. Yet here was a purely rural focus. Furthermore, there had only been one previous instance during this century of any cholera in Korea in May; seldom did it appear before the month of August. Then there were several peculiarities about the clams as found. In Korea they are not usually wrapped in straw for sale, they appeared here a month before their usual season (indeed since the beginning of the war they have not been reaching the markets at all), and if anyone had gone to the trouble of laying the packages down at various places on the hillside it was hard to explain why many of the thick calcareous shells of the clams should have been broken.

Light was thrown on the sequence of events, however, when the nature of the locality was examined. The clams were found in a zone some 400 yds. from a pumping-station at the top of the hill, and some 1000

yds. from a series of reservoirs or spring-fed ponds the water of which is drawn up by the pumping-station and distributed, partly for drinking, to several coastal settlements and port towns. On the night previous to that during which the clams made their appearance, the purification-plant adjacent to this pumping-station had been accurately destroyed by American planes using small bombs, the pumps themselves being undamaged. Further statements of local residents examined personally by the Commission (App DD) revealed that the weather on the night of the second raid when the clams appeared had been dark and windy. All these facts pointed unmistakably to a deliberate and carefully-planned attempt to contaminate drinking-water reservoirs, the scheme having failed in its main purpose because the weather conditions on the night of the delivery of the clams did not permit the pilot to locate the reservoirs. On the night in question they would not have presented a mirror-like surface.

It might still, however, be thought bizarre, that a marine or at least estuarine variety of lamellibranch mollusc should have been thought suitable for depositing in fresh-water sources for their pollution. Evidence of much interest, however, not only reminded the Commission that the cholera vibrio is a halophilic organism, but revealed the existence in the Japanese literature of researches which had shown the marine lamellibranch molluscs to be well suited as media for its growth (App. DD & EE). This provided the last link in the reconstruction of the plan for this kind of bacteriological warfare. During their slow osmotic death in fresh-water the molluscs would serve as natural culture-vessels for the cholera vibrios, liberating them at their death to contaminate the drinking-water for a period likely to be of the order of thirty days (App. EE).

Thus the Commission could only conclude that American air force units, following a careful plan previously established, first destroyed the Dai-Dong purification plant without damaging the pumps, and then attempted to contaminate the drinking-water reservoirs with cholera. The young couple who died, impoverished by war devastation, had the imprudence to eat some of the clams which had been intended as the vehicles of contamination.

This case should be studied in connection with evidence mentioned elsewhere (App. G) concerning flies as artificial carriers of cholera.

Types of Containers or "Bombs"

The time has now come to devote some attention to the types of containers, or "bombs", if the term is appropriate for engines of war which may contain little or no explosive material. At various times and places, particularly at Shenyang (Mukden) and in the neighbourhood of Pyongyang, the Commission had the opportunity of examining at leisure a variety of the containers in which biological objects had been delivered from the air. Its members were thus able to verify a number of the statements made in the Prague documentation, and to investigate in considerable detail newer methods more refined than any which had been described therein. As will be better appreciated shortly the task of the Commission was not rendered easier by a circumstance which soon became apparent, namely that some of these newer methods comprise "self-destroying containers", that is to say, containers which either break into pieces so small that their discoverey is unlikely, or containers which set fire to themselves and disappear after delivering their cargo. Moreover, throughout the Prague documents, and even in subsequent depositions collected by the Commission, there runs a streak of unavoidable confusion, due to the fact that even when eye-witnesses were on the spot when a container was delivered, they did not always succeed in finding it, partly because naturally they did not quite know what to look for, and when they did find it their descriptions were sometimes not as detailed as they might have been. This confusion was unfortunately not cleared up by the testimonies of the captured air force officers, whose status as pilots and navigators did not seem to have entitled them to very precise and detailed information on bombs and containers. It must be remembered that in one of the lectures which the pilots attended (Quinn/Ashfork; see below, p. 49 & App. LL) it was distinctly stated that "our bombs are still in the experimental stage, and there are various types of them". The contents of this paragraph must therefore be accepted with all due reservations.

The containers present a variety of forms and systems probably adapted to a variety of different cases. It seems also that pathogenic agents can be spread directly over the target area. In what follows it will be convenient to begin with this method, namely spraying, which involves no container at all, and to end with the self-destroying receptacles.

intermediate positions will be occupied by the less specialised devices whether parachuted or not.

(1) **Spraying.** In NCNA/85, p. 4, (Report of the Chinese Scientific Commission in Korea) the claim was made that a Chinese volunteer soldier actually saw an American plane spraying insects at Chor-Won from a height of about 900 ft. on Feb. 11th. It seems unlikely that this could have been anything else than a deduction from the fact that large numbers of insects were found anomalously on the snow over an oblong area 6 x 3 miles after its passage. Nevertheless the statements of all four American pilots are quite specific and concordant that in five separate lectures they were told that spraying could and would be done. One of these statements (O'Neal, ISCK/4, App. MM) includes a diagram of the equipment installed in the plane, and another (Kniss, ISCK/5, App. NN) says that its writer was informed that spraying would start in June. However, the former witness states his reasons for believing that spraying was going on from at least Feb. 18th, so the Chinese volunteer may have been right in his deduction.

As to the kinds of insects which could be so distributed, it seems certain that the method would be unsuitable for delicate creatures such as mosquitoes, but other discussions (App. L) indicated that it would not be unreasonable for fleas. It would of course be the way in which bacteria, viruses or toxins, would be disseminated in aerosol form.

(2) **Non-Exploding Objects and Paper Packets.** Several of the Prague documents have descriptions of the finding of paper packages of various colours from which insects were emerging. Again on the 11th Feb., Chinese volunteers at Chor-Won saw three American planes throw down such non-explosive objects, which turned out to be cylindrical yellow paper packets 8 inches high and 4 inches diameter (SIA/1, p.6; SIA/4, p.5). Elsewhere in the vicinity there were rectangular grey paper packets, 4 x 4 x 1¼ inches containing insects. White paper packets are spoken of as having been delivered at Pyongyang on 4th Mar. (NCNA/85, p.8) and brown ones at Chang-Do on 10th Mar. (NCNA/85, p.6). Two of the lectures attended by the captured pilots (Enoch/Wilson and Quinn/Ashfork, see below, p. 49) described the use of paper as a packing for infected insects. While it seems conceivable that hardy insects might be dropped from a low height simply wrapped in this way, it seems more probable that in all cases the packets originated from the interior of metal leaflet-containers or "bombs" which had exploded and opened in mid-air. To these we now turn.

(3) **Air-Bursting Variable-Time Fuse Leaflet Bomb.** This type of container is the one which has figured most in all accounts hitherto published on bacteriological warfare in Korea and China, and it is certainly the commonest type in the collections which the authorities of those two countries have made. Members of the Commission saw many examples of it. This bomb is of approximately the same size and shape as the ordinary American 500 lb. HE bomb, but it weighs only about 150 lbs. and can therefore be loaded on to the planes by hand (App. OO). It consists of a conical nose-piece at the tip of which is the time-fuse. This nose-piece forms a small empty compartment, and below it the cylindrical body of the bomb is divided by three steel diaphragms into four separate compartments. The casing is divided longitudinally so that half of it, being mounted on hinges, can swing open and release its contents at any moment desired. Below the floor of the lowest compartment the casing narrows again to form a conical empty space from the sides of which spring the four tail-fins, and in the bottom of which is a hole sufficiently large to permit of the escape of a parachute if it should be desired to equip the bomb with such a device. There has been some divergence in the published measurements of the bomb (NCNA/85, SIA/13, ISCC/4, etc.) but the specimens seen by the Commission and described by the captured pilots have a total length of approximately 4 ft. and a diameter of 1 ft. 2 in. The casing is made of 1/8 in. steel, and the total capacity of the 4 compartments is of the order of 14½ gallons. The length of the time-fuse is a little more than 3 in. Markings seen were "Leaflet Bomb — 500 lb. — M 105 Lot — U.S. Time (-fuse)-Empty." According to the descriptions given by the captured airmen (App. KK-NN) the doors of the bomb are supposed to open at a height of about 100 ft., distributing the contents over an area likely to be about 300 ft. in diameter.

The classical eye-witness description (NCNA/85, SIA/13) is that of an army doctor who on Mar. 26th saw an American plane, circling over Yong-Won, drop two bombs in a power dive. Both split into two on exploding and gave rise to an insect-congested zone some 200 yards long and 100 yards broad, with a maximum density of 100 insects per sq. yard, centering on the craters (5 in. deep) made by the bomb halves (NCNA/85, p. 5). The Commission had the opportunity of personal interrogation of eye-witnesses, mostly peasant farmers, who had found three such leaflet-bombs surrounded by insects after they had been dropped by planes on Mar. 27th and 31st at Ch'ang-Pai in Liaotung Province (ISCC/4; SIA/10). Again, while at Pyongyang, the Commission inspected a collection of these containers, and here reproduces a table of details concerning them (c.f. App. Z).

Serial No.	Date	Time	Place	Province	Remarks
208	26/2	night	Pyong-Won	Pyong-An-Nam	flies temp. -4°
209	28/2	dawn	Kim-Hua	Kang-Won	flies 300 × 300 ft. temp. -3°
205	28/2	8 p.m.	Pyong-Won	Pyong-An-Nam	flies
210	1/3	morning	Shin-Chun	Huang-He	flies in discoidal zone centering on point of impact, 2700 sq. ft. temp. -1°
201	5/3	midnight	Moon-Chun	Kang-Won	flies, 600 × 300 ft., lethargic
207	10/3	4 a.m.	Sung-Chun	Pyong-An-Nam	flies in discoidal zone centering on point of impact, 150 ft. diam.; greatest density 20-30/ sq. yd.
204	21/3	night	Moon-Chun	Kang-Won	flies
206	26/3	9 a.m.	Nyong-Won	Pyong-An-Nam	flies in discoidal zone centering on point of impact, area 100 sq. yds.

It only remains to add to the above that this type of container was described in more or less detail in every one of the nine lectures attended by the four captured airmen who gave evidence before the Commission. In all four cases, too, the airmen believed that the bacteriological bombs which had been loaded on to their planes and which they duly dropped, were of this type (App. KK-NN).

As is well-known, public disputes have arisen in the international press about the use of leaflet containers, but the chief of the American Army Chemical Corps is on record for the statement that they are well suited for the delivery of biological objects (SIA/9, p.1; NCNA/85, p.5; ISCC/4).

(4) **Air-Bursting Propeller-Armed Leaflet Bomb.** This container would appear to be a variation of that just described. The fuse in the nose would be armed by a small passive airscrew or propeller which would bring about detonation after a certain number of revolutions. There is hardly any mention of this type in the documentation issued before the Commission began its work, nor was any evidence found of its use. However, it was described in one of the lectures which the captured airmen had received (O'Neal/McLaughlin, see below, p. 49).

(5) **Leaflet Bomb with Doors opened by a Propeller.** In this type, which would be similar in external appearance to both those just described, the passive propeller or airscrew in the nose would actuate a mechanism to open a series of doors along the length of the bomb after it had carried out a predetermined number of revolutions. The packets are then blown out by the wind. Again there is no mention of this in the Prague documentation, nor did the Commission find direct evidence of its existence or use. But nevertheless it was described in one of the lectures which the captured airmen had received (Quinn/Ashfork, see below, p. 49).

(6) **Leaflet Bomb with Doors or Sides opening after Impact.** Here the half-side of the bomb, or a series of doors in it, would be opened by mechanism driven by electric battery activated only by the shock

of impact. Breakage of a plastic partition would permit access of the acid to the plates. This was not mentioned in the Prague documents, nor was direct evidence of its existence found. But it was described in one of the lectures attended by the captured airmen (Quinn/Ashfork, see below, p. 49) who was afterwards able to make a sketch of it in his deposition (App. LL). From the descriptions it would follow that this type of bomb must be equipped with a parachute, and it is possible that this was the container referred to in their lectures as delivering infected insects by parachute (O'Neal/McLaughlin; Kniss/Holleman; Kniss/McLaughlin). One of them (App. MM) was able afterwards to make a sketch of what he conceived such parachute containers to look like.

(7) **Paper or Carton Cylinder with Silk Parachute.** The only type of parachute container which the Commission actually saw was one which is said to be similar to those used for flares. It is a carton cylinder with walls about ⅜ inch thick, some 1 ft. 2 inches long and 5 inches diameter. The examples seen were marked "USC 5/1 — 1 — 1952 — Lot 100 — F — .6." The silk parachute attached had a diameter of only 2 ft. 3½ inches. As has been pointed out (NCNA/85, p.5), this size is only one thirtieth of the ordinary flare parachute, so that presumably it would not be likely to float for a long time in the air. It was also pointed out that there was no trace of burning on the carton, and this was certainly true of the examples which the Commission examined. It may well be significant that on one of the occasions when such a receptacle was found, it appeared to have delivered midges (Kang-Dong, 26th March, NCNA/85; SIA/13). Delicate insects such as these (*Orthocladius*), or mosquitoes, would doubtless conveniently be delivered by such a method.

(8) **Paper Container with Paper Parachute (Self-Destroying).** Of this interesting type no example was seen by the Commission nor had the captured airmen any information to give about it. But such a device was described in some detail in the article by Maj. R. Sakaki in *Mainichi* for January, 1952 (App. Q). According to this account, the container would be of strong paper and would include several compartments, it would be weighted, and it would carry a fuse so arranged as to be able to ignite both the container and the paper (or impregnated silk) parachute when the proper moment arrived. In Sakaki's description the biological objects (plague-infected rats) would be gently liberated after the container had opened on touching the ground, and then after a sufficient latent period the ignition would occur and no trace would be left. But the machine could easily be so arranged as to deliver its load some 20 or 30 ft. above the ground, after which, becoming lighter, it could drift further away before ignition and disappearance. The circumstance that Sakaki

specifically refers to the use of these containers for plague-infected rats made it tempting to suppose that a battery of them had been used in the Kan-Nan incident (p. 27 above), but for this there is no specific evidence. One corollary of paper containers for rodents would be that the animals might have to be kept in at least a semi-anaesthetised condition during the flight, to prevent them from gnawing their way out. The Commission places these points on record only for the purpose of drawing attention to possibilities.

(9) **Bomb-shaped Containers of Earthenware or Porcelain.** During the second world war, the Japanese bacteriological warfare organisation manufactured "porcelain" (actually earthenware) bomb-shaped containers, of at least two different sizes, in a special plant near Harbin. Specimens of these (the larger about 2 ft. 6 inches and the smaller about 1 ft. 6 inches long) were examined by the Commission at Shenyang (Mukden). Although this kind of container is still recommended in Japan, as by Sakaki in the article already mentioned (App. Q), for bacterial cultures, the Commission did not find any evidence for its use in 1952 in Korea or China. Here it takes its place rather as the precursor of the most ingenious of all the types in question, namely the "egg-shell" container which breaks up on impact, but into a great number of small and thin pieces easily overlooked.

(10) **The Artificial Egg-Shell Container.** On March 21st, more than two hundred fragments of a container made of some calcareous material, together with a cap-shaped steel plate and metal rod attached to the centre of the concave surface, were found outside the city of K'uan-Tien in Liaotung province.. Circumstances (reported in ISCC/3, App. V) showed that these things must have been the remains of a container which had fallen from an American plane on the 12th, and in which there was reason to think that anthomyiid flies, spiders, and fowl feathers, bearing anthrax bacilli, had been delivered. The metal pieces and calcareous fragments were subjected to an exhaustive analysis by the Institutes of Modern, and of Applied Physics, of Academia Sinica (the Chinese National Academy), with a view to reconstruction of the original form of the device (App. V).

It was thus possible to deduce that the intact container must have been cylindrical, and domed at least at one end. The total length would have been more than 1 ft. 3½ inches, and the length of the rod 11 inches App. V). The radius of curvature of the steel cap plate is just under 5 inches, and its diameter 6¾ inches; the radius of the calcareous body of the container 5½ inches. The thickness of the calcareous walls would have been just over 1/16 inch, and the whole had been painted on the outside with aluminium paint. X-ray examination demonstrated that the

material of the walls was chiefly calcium carbonate. While mainly calcite, the substance contained, as was shown spectroscopically, some magnesium. By some means or other, then, a fragile calcite box had been fashioned, and chemical evidence was obtained of the presence of organic matter, which had served perhaps as a cement for the calcite particles. Something is still lacking in our understanding of the facts since it is not yet clear how so fragile a container can stand the shock of departure from the plane.

The incident at K'uan-Tien (ISCC/3) had already been partially reported in SIA/3, p. 2 and SIA/8, p. 6, and the Commission was able to examine the calcareous fragments preserved from it. But it did not represent the only incident of the kind which came to the notice of the Commission. As late as June 6th, the delivery of insects to the neighbourhood of Pi-Tung (N. Korea) had been accompanied by what was described as the rather slow slanting fall of silvery globes about twice as big as footballs (App. X). There can be little doubt that this was the same device again. Moreover, one of the eye-witness accounts of the Pai-Ch'ing-Tzu cases (ISCC/5; SIA/6, p. 1) mentioned shining objects dropped by American planes. Here, too, masses of feathers infected with anthrax were delivered. Other descriptions (e.g. SIA/10, p. 1 and App. G) might refer to this type, but it is not possible to be sure. In any case, the Commission considers that there can be no doubt that such containers were used by the Americans on both sides of the Yalu River in March and in June.

(11) **Miscellaneous Containers.** It only remains to add that evidence has been produced of the use of several other kinds of receptacles besides those already mentioned. For rodents there has been mention of cylindrical cages of wire-netting (NCNA/85, p.5) and of wooden boxes (NCNA/85, p.6). If these indeed descended from the sky, it was more probably as part of the cargo of some kind of parachute bomb. Packages of straw were used for the cholera clams of Dai-Dong (App. CC). A hand-grenade type of bomb has also been mentioned (NCNA/85, p.6; SIA/13); the Commission did not see this. Members did however have the opportunity of examining near Pyongyang fragments of a green translucent insect container which, it was stated, had been fired as a shell (NCNA/85, p.5, 6; SIA/13). Artillery participation in bacteriological warfare was referred to in at least two of the lectures attended by captured American airmen (Enoch/Wilson and O'Neal/Williams, see below, p. 49); but the Commission found no evidence of the practical use of the method of warfare described by Sakaki, namely of covering pieces of shrapnel with jelly containing *B. welchii* (gas gangrene) or tetanus (App. Q). Cotton filling for padded winter clothing, however, which

appeared at one time conveniently near the Chinese trenches, was found to be contaminated with paratyphoid B (comm. from DGMS, CPVF).

(12) **Ground Distributions of Biological Objects Delivered.** Those who read the appendices to this Report as well as the earlier documents issued from Prague will find eye-witnesses constantly speaking of discoidal insect-congested zones, centered on the remains, generally quite uncrumpled, of the leaflet-container "bomb". This presumably means that there was a fairly regular concentric distribution around the spot immediately beneath which the opening of the container had taken place.

Apart from these cases, the Commission noted two interesting examples of ground distribution of delivered objects. In one case (ISCC/5) (App. AA & BB) feathers were found being blown away slowly by the wind from their point of arrival, so as to form a triangular area ½ mile long and rather less than ¼ mile broad at the base. This was gradually lengthening and broadening. Though no container or its fragments were found, the bomb in this case was probably of the egg-shell type. In another instance, that of the great numbers of human fleas found on a bare hillside (ISCK/3; App. T & U), it was seen that the insects covered an ellipsoidal area about 30 yds. x 10 yds. with a zone of maximum density at approximately one of the centres or foci of the ellipse. This would presumably suggest that the fleas were delivered by some object, perhaps a parachute container, which travelled along the long axis of the ellipse.

Testimonies of Captured Intelligence Agents

The Korean authorities informed the Commission that since the beginning of the war agents had been sent into North Korea with the precise objective of obtaining and sending back epidemiological information related to bacterial warfare. Many of these agents had been captured, and their admissions had thrown considerable light on the organisation of the American intelligence service and the work which had been entrusted to them. Already in SIA/7 detailed information had been published concerning some of the agents, for example one Chinese and one Korean.

Members of the Commission had the opportunity at Pyongyang of interviewing at length one of these agents, (App. JJ). The young man, whose schooling had been cut short, belonged in 1945 to the "Youth Organisation" of the South Korean Government, and when the American troops finally retreated he had gone with them. Minor personal interest, rather than political conviction, had apparently been the dominant motive in his antagonism to the North.

Unable to make a living, the witness joined the American auxiliary intelligence forces. He described the political, military, and hygienic training which he had received in an organisation entitled "K.L.O." at Seoul between December, 1951 and March, 1952, (App. JJ). Here he was taught the techniques for obtaining the information desired. It was during this period that the bacterial warfare developed. Numerous inoculations were given to him about the beginning of February, though he was not informed of their nature. Until the eve of his departure he had no contact with foreign military officers, but his final instructions were then delivered to him by an American major through an interpreter. These comprised a specific area for his operations, and gave exact details of the diseases about which the Americans wanted to know (typhoid, plague, cholera, encephalitis, dysentery, and smallpox). The witness was informed as to the systems on which North Korean statistical information was drawn up, and his instructions were to obtain it if possible by means of contacts in the health and other governmental services, or if need be, to steal it. He was also told to be extremely careful of what he ate, not to pass the night in places infected with insects, and not to drink unboiled water. North Korea was full of illness, it was said, but his inoculations would give him great protection.

The witness accordingly passed into North Korea on the 29th March, and worked there with an accompanying radio-telegraphist until he was arrested on the 20th May. In replying to questions, he was rather reticent, perhaps to shield collaborators. He said that he had very little success in contacting North Korean health personnel, and had been able to transmit little or no information to American headquarters.

The witness made it clear that before his illicit entry into North Korea, he had been given no indication that bacterial warfare was being carried on. He had only heard that there were numerous epidemics in the North, and that the armies of the South "were employing the most modern scientific weapons with good results." He learnt of bacterial warfare only from reading public notices.

The Commission was unanimously of the opinion that the bearing of this witness and his evidence about his mission and instructions bore the stamp of truth, and that any pressure, physical or mental, could be excluded. For the rest, he seemed to be a rather mercenary personality. The Commission found no improbability in the sending of epidemiological intelligence agents across the lines. It was satisfied that the task of the agent had been to provide information about the effectiveness of bacteriological warfare; a conclusion which could only add to the cumulative mass of evidential material inculpating the American armed forces.

Testimonies of Captured Airmen

On Jan. 13th, 1952, a B-26 bomber of the American Air Force was shot down over An-Ju in Korea. By May 5th statements of considerable length admitting their participation in bacteriological warfare had been made by the navigator Lt. K. L. Enoch, and by the pilot, Lt. John Quinn, and issued to the world through Peking. As has already been stated, these documents will be found in SIA/14 and 15 respectively, and together with lithograph reproductions of the original manuscripts, in the printed brochure issued from Prague. The relevant parts are here reproduced in App. KK. and LL. Documents SIA/17 and 18 should also be consulted, though the later interviews recounted in them did not add much to the technical and scientific evidence.

What were the essential points in the principal declarations of these airmen? First of all, both officers had had to attend, in Japan and in Korea, secret lectures on the methods of bacteriological warfare. These expositions, which it was impressed on them contained highly confidential information, described the use of bacteria directly as cultures deposited or sprayed, of insects transmitting diseases biologically or mechanically, of rodents in parachute-containers, of poisoned foods, and of bacteria-containing artillery shells. Various kinds of containers or "bombs" were described and sketched. Correct altitudes and air-speeds for delivery were given. Particularly significant statements made in the lecture attended by Lt. Quinn were (a) that "almost any insect could be used for spreading diseases", (b) that "rats could be dropped, though this might not be necessary", and (c) that there was an intention to use encephalitis, "for which no positive cure is known."

Secondly, both officers had received orders to carry out bacteriological warfare missions, and had duly flown them, though with the greatest inner reluctance. There were various peculiarities about the special bombs used, and in some cases these were under special guard so that the pilots could not examine them too closely. In one of the reports information was given as to the various types of planes most suitable for delivering various kinds of containers. From the personal knowledge of the two airmen many of their fellow service-men had also engaged in such missions, and later conversations brought out well the large number of Air Force personnel who had been instructed on bacteriological warfare,

(SIA/17). Lt. Enoch was briefed "germ bombs" while Lt. Quinn was briefed "duds", but both were told that in debriefing (i.e. reporting the results of the flight) "duds" was to be the term used.

There can be no doubt that these admissions had considerable influence on the western world. But those who did not wish to be convinced tended to brush them aside as confessions obtained under physical or mental duress, saying that after all, only two young men had come forward, and suggesting indeed they did not really exist at all, and that the whole declarations were forged. Attempts, however, to demonstrate inconsistencies in Lt. Quinn's story, failed (SIA/16).

In these circumstances it was of great importance that the Commission was able to meet, at a rendezvous in Korea, not only the two officers so far mentioned, but two more, Lt. F. B. O'Neal and Lt. Paul Kniss, whose accounts are even more lengthy and detailed (App. MM & NN). With these four American airmen, the Commission found itself in presence of a good cross-section of American life—a cool-headed electrical engineer; a middle-class business man; a young research chemist, and a solid steel-mill worker of agricultural origins. The Commission had the opportunity of extended conversations with these four men under conditions of free discourse. Its members unanimously formed the opinion that no pressure, physical or mental, had been brought to bear upon these prisoners of war in order to induce them to make the declarations which they made. These declarations were made of their own free will, after long experience of the friendliness and kindness of their Chinese and Korean captors had brought to them the realisation that their duty to all races and peoples must outweigh their natural scruples at revealing what might be considered the military secrets of their own government. The greater part of the conversations consisted in question and answer among the airmen and the members of the Commission, but each airman prefaced his interview with a statement along the lines of his written document, and concluded it with a solemn affirmation of the convictions to which his conscience had brought him.

Since the statements of the witnesses (ISCK/4 & 5), and the commentaries containing the substance of the interviews, are reproduced below as App. MM, NN and OO, there is no necessity to elaborate them further here. But from the written statements and answers to questions it seems already possible to reconstruct what was going on in the American air force during the last months of 1951 and the early months of 1952. This may be appreciated by means of the following table:

1951 June —Kniss attends lecture by Laurie in U.S. Information given because the enemy might use bacteriological warfare.

Aug. 25th—Enoch attends lecture by Wilson in Japan. The U.S. has no plans for bacteriological warfare, but the enemy might use it.

Oct. —Enoch attends lecture by Browning in Korea. Same statement.

Dec. 1st —O'Neal attends lecture by Williams in U.S. Non-committal attitude on intention to use bacteriological warfare.

Dec. —Enoch attends another lecture by Browning in Korea. Same statement as in Oct.

Dec. 18th—Quinn attends lecture by Ashfork in Korea. Necessity of preparing for bacteriological warfare which the enemy might use.

1952 Jan. 3rd —Quinn's first mission with bacteriological bombs. Briefed and debriefed as "duds", but from other circumstances he knew what they were.

Jan. 6th —Enoch's first mission with bacteriological bombs. Briefed as "germ bombs", to be debriefed as "duds".

Jan. 22nd—O'Neal attends lecture by McLaughlin in Korea, Bacteriological warfare stated definitely to be in use.

Feb. 15th—O'Neal's first mission with bacteriological bombs. Briefed as "germ bombs", to be debriefed as "air-burst VT".

Feb. 18th—O'Neal sees evidence of the use of spraying technique, from specially adapted planes.

Feb. 22nd—Kniss attends lecture by Holleman in U.S. Use of bacteriological warfare definitely denied, but possession of weapons by the U.S. admitted.

Mar. 21st—Kniss attends lecture by McLaughlin in Korea. Bacteriological warfare stated definitely to have been in operation since 1st Jan. Clear statement that the U.S. Government would continue to deny it as long as possible.

Mar. 27th—Kniss' first mission with bacteriological bombs. Briefed as "flak-suppressor," to be debriefed as "results of mission unobserved."

From the above facts the conclusion can hardly be avoided that the order to begin bacteriological warfare upon the people of North Korea and China must have been given late in 1951, air personnel having previously been prepared for the work by cautious informatory lectures, and not apprised of what they were expected to do, even after Jan. 1952, until their actual arrival in Korea. At American and Japanese bases, bacterial warfare was said to be a theoretical and purely defensive matter; but at Korean bases pilots were surprised to find that it had already been started weeks or months before their arrival. The fact that the general order must have been given during the period of the Kaesong peace talks was not overlooked by the pilots.

For the rest, the independently heard testimonies of the airmen contained several points of interest. It was noteworthy that they did not

remember ever having received any instruction on the recognised customs and usages of war, such as the prohibition of the shooting of prisoners, nor of having seen any regulations relating thereto in American manuals of procedure; still less had they heard of the outlawing of certain forms of war, at least by certain nations. Then the testimony of the witnesses was unanimous as to the disastrous effects on the morale of their fellow service-men of the orders to carry out bacteriological bombing. It was the last straw for many of them already disgusted by the ferocity with which they were being hounded on to slaughter the civilian population of North Korea (App. OO). The revulsion of feeling which the witnesses then underwent, when after their capture they were treated in such a friendly way by the Koreans and Chinese, who evidently no longer regarded as enemies those who had laid down their arms, can well be imagined.

The officers interviewed did not seem very well-informed on the variety of types of containers being used, but this was doubtless because as pilots and navigators they were not supplied with the information which armament officers would have had. They were also able only to speculate as to the place of origin of the biological material used, but significantly some of them thought that it might be in Japan.

In sum, the Commission, as the result of exhaustive conversations and direct personal contact, saw every reason to accept the veracity and to uphold the integrity of the officers who gave evidence before it. They appeared fully normal and in perfect health, they spoke in a natural way and seemed fully at their ease. The Commission once more affirms its belief that the airmen were not subjected to any physical or mental pressure, and that their treatment was worthy of the best traditions of Chinese humanism. The Commission therefore accepted as true and faithful the evidence of the airmen, which complemented indeed in many ways the strictly scientific and observational evidence already accumulated from the field.

Hygiene in New China

The Commission was deeply impressed by the present hygienic conditions of the Chinese people and by the measures which are being taken to raise the hygienic standard and to combat the spread of epidemic diseases. These measures are effective and thorough. The idea that the Chinese people live in a very unsatisfactory hygienic situation is widespread in the West, but even a superficial first-hand acquaintance with the conditions now prevailing, and with the enthusiasm shown by the Chinese population in carrying out the health directives of the government, is sufficient to dispel it (App. PP).

A few figures may be given to indicate the extraordinary progress which has been brought about in a few years. In Northeast China 35 million rats were killed in 1951, and 10 million in the spring of 1952—a war against rodents unparalleled in any other part of the world. The fight against flies and other insects capable of acting as vectors of disease has assumed a universal character, and Peking has become a city almost devoid of flies and mosquitoes. Before the liberation, vaccination against smallpox was sparse and inefficient, the largest number of persons vaccinated in one year (1946) being no more than 7.3 million. But in three years since the liberation 307 million people have been vaccinated, and the disease has been almost entirely eliminated. Re-education of midwives has lowered the infant mortality rate from Tetanus neonatorum, by one third between 1949 and 1951. Infantile mortality as a whole, and maternal mortality, were reduced by one half in the same period. The numerous practitioners who follow the system of traditional Chinese medicine have been mobilised as auxiliaries in the great campaign for health, and have proved both able and willing to receive such instruction in modern medicine as equips them to play a useful part. In Peking and other great cities there has been a complete elimination of stray dogs, which were suspected of being reservoirs of encephalitis virus and vectors of many infections.

Besides all this, there has been great progress in the organisation and productive capacity of the laboratories producing vaccines and sera. The Commission visited the relevant Institute in Peking, and was impressed by its efficiency, high production, and excellent scientific research quality.

The health movement is not confined only to Peking or a few other "model" cities. Reliable informants asserted that it reaches far into the

remotest corners of the sub-continent. The Commission as a body had the opportunity of seeing this for themselves during their travels in the Northeast, which included a visit to remote places in the north of Heilungchiang province, on the borders of Inner Mongolia. The members were much impressed by the cleanliness of the villages.

Since the liberation, indeed, there has been a health education campaign in China of a breadth and scope probably hitherto unattained elsewhere. The whole-hearted cooperation of every member of the population, man, woman and child, has been necessary for the results which have been achieved. The clearing away of accumulated rubbish, the scrupulous cleaning of courtyards and waste-land, the screening of windows, the fight against all kinds of noxious insects, the production and use of insecticides and vaccines—every possible aspect of a constantly and rapidly rising general level of public health has been thought of and executed with verve and thoroughness. The fundamental education has been carried out by every available means of instruction, by large meetings, by posters, picture-books and wall-newspapers, by the press, from the stage, and on the screen.

When confronted with bacteriological warfare, or even the suspicion of it, the peasant masses of China knew exactly what to do, and did it without the least confusion or panic. The Commission was able to visualise, through personal contact with a large number of witnesses from many parts of the Chinese countryside, the disciplined action of hundreds, indeed thousands, of ordinary folk, guided by instructions from the central and regional Ministries of Health, combing their fields and streets to collect and destroy everything which issued from containers arriving from the air.

The hygienic progress in China today constitutes the active execution of measures more or less vainly urged by successive international health organisations. The achievement of so much progress in so short a time would not have been possible if the Chinese government had not been able to count upon the unconditional support of all classes of the population. Peasants and factory workers, scholars and religious groups, have approved its aims and done their best to achieve them.

General Considerations

It will now be useful to assemble certain facts in tabular form, not only those which were summarily set forth in the Prague documents, but also those which were brought before the Commission during June, July and August for examination. A certain number of the clearer incidents will be found in the folding table (App. G). For each case there is recorded the reference number, date, place and circumstances, whether the passage of a plane was noted, and whether any object was seen to fall, whether a container was found, and what areas unusually congested with insects or other biological objects were observed, together with notes on the density of the animals, where possible. There follows the entomological or zoological identification, the results of bacteriological tests, and any epidemiological remarks. It must be understood that only a small number of the known incidents is included in the Table.

It will be clear from this summary tabulation that the appearance of biological material found to be infected with pathogenic micro-organisms was not always followed by human cases of disease. This must be in great part attributed to the speed with which the country and townspeople throughout the districts affected have searched for and destroyed any unusual animals and objects which there was reason to think might have been disseminated from the air. So effective have these operations been that in many cases no samples were saved for bacteriological analysis, as the Table shows. In other cases, bacteriological analysis gave negative results for those types of pathogenic organisms for which tests were made.

Here it is worth noting that the incursions of planes over Northeast China have been numerous during the year, and that for the most part they have not been accompanied by bombardment with explosives. Between the 29th Feb. and the 21st. Mar., American planes made 955 sorties in 175 groups over NE China (Manchuria), covering 70 hsien districts in the provinces of Liaotung, Liaohsi, Chilin, Sungchiang and Heilungchiang (SIA/3). Other similar figures have also been given (NCNA/85; SIA/13), and the air intrusions over China have recently intensified rather than decreased. In the eight days ending 7th Aug., for instance, American planes made 398 sorties in 79 groups over Chinese territory.

The geographical distribution of the incidents in NE China is also interesting (see Map, App. G). Down to the end of April, taking well-analysed incidents only, the greatest number (18) had occurred in Liao-

tung province, which borders most of the Korean frontier. Here the fact was striking that almost always the incidents were reported from the immediate neighbourhood of railways and main roads. The same peculiarity was noteworthy in the 8 incidents which occurred in the remotest province, Heilungchiang. Here one of the railway lines north of Chichihar and Harbin describes a vast S-shaped bend, with sides of a hundred miles or more—all along this line the incidents were dotted.

Documents previously published gave on the one hand some of the bacteriological and epidemiological details relating the infected insects with cases of human disease; and on the other hand evidence relating the insects to the passage of planes. Sometimes the data furnished in those documents were incomplete. This was one of the reasons for the exhaustive enquiries which the Commission made, in collaboration with the Chinese and Korean scientists, with regard to the incidents at Hoi-Yang, Kan-Nan, K'uan-Tien, Liaotung and Liaohsi, Dai-Dong, etc., recounted in the preceding paragraphs. From all these investigations it will be seen that the connection between the planes, the vectors, and the cases of human disease, can no longer be contested.

At an earlier point, the method of incident analysis was explained. The moment has now come to assemble the data from the most fully analysed cases in the form of a synoptic Table p. 55. From this confrontation of patterns, an organic plan clearly emerges. Planes were always seen or heard, and their course often plotted; and the statements of captured pilots later added supplementary detail. There follow in the Table the necessary data on the fall of containers, the vectors employed and their anomalies, the bacteriological tests, and the clinical cases following.

In connection with all these facts, the Commission heard and interrogated a large number of ordinary Chinese country-folk. Its members were convinced of the integrity and stolid honesty of these witnesses, whose depositions were marked by plainness and clarity.

Turning to specific questions, the Commission considered the possibility that the plague in Korea might have been transported by incoming traffic from those areas in Northeast China (Manchuria) where it still remains endemic. There are several reasons why this possibility must be ruled out. First, no case of plague has at any time been reported from the regions which separate the new Korean foci from the above-mentioned endemic areas. Secondly, there were very serious seasonal anomalies in the occurrence of the plague (see App. G, R & S). Third, in the Korean foci the characteristic appearance of dead rodents, denoting an epizootic, before the human epidemic begins, was entirely absent. Fourthly, the clinical effects were often demonstrably connected with the previous pas-

	Plane: seen or heard	course plotted	crew interrogated	Delivery: objects seen to fall	Container: found	Spraying suspected	Animals or other Vectors: Anomaly of high concentration	Anomaly of season	Anomaly of locality	Anomaly of species	Animal or other Vectors: Bacteriol. examination	Disease, human, cases following	Anomaly of season	Anomaly of locality	Anomaly of type of disease	Disease, vectorial	Anomaly of season	Anomaly of locality	Anomaly of type of disease
An-Ju (K, plague) SIA/1, 4	+						+		+		+	+	+	+					
Cheum-Dom (K, plague) SIA/1	+			+	+		+	+	+	+	+								
Kan-Nan (C, plague) ISCC/2	+	+					+	+	+	+	+					+	+	+	+
Kang-Sou (K, plague) ISCK/2	+					+	+		+		+	+	+	+					
Hoi-Yang (K, plague) ISCK/3	+						+		+		+								
K'uan-Tien (C, anthrax) ISCC/3	+	+		+	+		+	+	+	+	+								
Liaotung (C, resp. anthrax) ISCC/5	+ + +	+ + +		+ + +			+	+	+		+	+	+	+	+				
Pi-Tung (K) App. X	+			+			+					+							
Ch'ang-Pai (C) ISCC/4	+			+ + +	+ + +		+	+	+	+									
An-Shan (C, encephalitis) ISCC/6		+				+						+	+	+	+				
Dai-Dong (K, cholera) ISCK/1	+				+		+	+	+	+	+	+	+	+					
Airmen (ISCK/4, 5; App. KK, LL, MM, NN, OO)	+	+	+	+	+	+	+				+								

sage of planes and the dissemination of suitable vectors. Finally, the most stringent sanitary precautions are, and were from the beginning, taken both by the Chinese and the Koreans at the frontier between the two countries.

Several of the diseases used are connected with domestic animals as well as man, for example anthrax (NCNA/85; App. AA). When the discovery of *Pasteurella multocida* (*septica*) on certain disseminated vectors (App. G) was confirmed, it seemed at first to have little importance since it is so common an infection of laboratory animals. There are reasons, however, for supposing that it might be used as a weapon against domestic stock (App. QQ).

As for the *Vibrio cholerae,* though in the detailed case studied above (Dai-Dong) it appeared in contaminated molluscs, there have also been not a few cases (App. G) in which it has been found on insects, especially flies. The same has also been true for *Salmonella typhosa* and *paratyphosa,* and for *Shigella dysenteriae.* These pathogens have been found on populations of flies appearing in areas where no cases of these diseases had been known. This raises the question of the possible existence of pathogenic micro-organisms in or upon normal flies collected at random. The Chinese medical literature contains studies (App. D), published many years before the present hostilities, in which exactly these controls were made. They showed that in non-epidemic periods, normal flies did not carry the bacteria of typhoid or paratyphoid fever, or the cholera vibrio. The relevant appendix adds a further note on certain similar studies made this year in Shenyang (Mukden).

A question related to this is the use of quantitative methods of investigation in the study of the carriage of bacteria by insects; it is treated of in a special appendix (app. C).

A few words should be added concerning the part played by insect vectors, to complete what has already been said in the Prague documentation and elsewhere. One Appendix (H) is devoted to the zoological identification of the insects disseminated; another (B) will help the reader in the general study of problems of medical entomology relating to bacteriological warfare.

In the earlier reports there were a certain number of questions, especially as regards events in Korea, which still remained open. During its stay in Pyongyang, therefore, the Commission submitted to the Minister of Health, Dr. Ri, a series of questions, to which answers were in due course received (App. I). It thus appeared that some translations had been faulty. The word "tick" used in the first Korean report (SIA/1) had in fact been a reference to the red mite, *Trombicula*

akamushi.. As for the nycteribiid flies, parasitic on bats, also mentioned in the same document, the Commission was informed by the competent Korean authorities that it could not now be considered demonstrable that these insects had been connected with the bacteriological warfare.

Confirmation, however, was obtained for the statement that dead fishes contaminated with *Salmonella* and *Shigella* had on more than one occasion been found lying on hillsides. It was emphasised that these phenomena had always occurred in the neighbourhood of drinking-water sources. This recalls the Dai-Dong incident investigated in detail by the Commission (p. 35 and App. DD) where the purpose of spreading cholera clearly appeared.

A question which had particularly aroused the curiosity of western scientists, and about which the Commission was seriously concerned, was that of the "lyophilised proteinaceous material" discovered after the passage of planes (NCNA/85). This substance, found in separate masses, was sticky and hygroscopic, absorbing water as it lay on the surface of the snow. Chemical analysis showed that it was composed of protein breakdown products; proteoses, peptones and polypeptides. The bacteriologists were able to isolate from it mannitol-fermenting dysentery bacilli. No incident of this kind took place during the period of the Commission's work in Korea, and it had therefore to rely upon the reports of the Korean services, but it found entirely probable the hypothesis accepted by the Minister himself, namely that the material represented the delivery of freeze-dried bacterial cultures as such.

As for the question of the dissemination of insects under conditions of very low environmental temperatures, the Commission points out (though not itself prepared to subscribe necessarily to such affirmations) that in their evidence the captured airmen alluded to methods directed to the production of insect populations specially endowed with cold-resistance (App. MM).

In a preceding paragraph (p. 14), eighteen species of insects and arachnids disseminated from airplanes were described. Of these, nine have been definitely incriminated by bacteriological tests as infected with pathogenic micro-organisms. What is to be said of the others? The Commission could not conclude that they were perfectly clear from infection. It is a difficult matter to isolate pathogenic micro-organisms from such material when no one knows exactly what should be looked for, all the more so when artificially selected bacteria and viruses are in question. The possibilities are far from having been exhausted.

In the American literature on bacteriological warfare there are some contradictions with what has been seen in Korea. Certain judgments

expressed in works not yet superseded are hardly in accordance with the observations of the Commission. It seems likely that in some important cases technical advances have rendered these opinions obsolete. The case of plague is typical. Ten years ago Rosebury cautiously expressed the view that it might be possible to spread this effectively for warlike purposes, but only in areas remote from the front lines owing to the great danger of the infection of friendly territory. In Korea the Commission's work has revealed repeated attempts to diffuse plague at places not far removed from the front lines, contrary to the opinion of so experienced a bacteriologist as the former Director of Camp Detrick. But the contradiction is only apparent. The last ten years have seen enormous progress in techniques of disinfestation; on the one hand new and ever more potent insecticides, combined in various mixtures, and on the other hand machines of high efficiency for the dissemination of clouds of these substances in large amounts and minimum time, sufficiently simple to be operated by any ordinary person. These machines derive from smoke-screen apparatus developed during the second world war.

Practical experience has shown that such methods can be used for the eradication of diseases caused by insect vectors from whole territories. Recent published information shows that the American forces in Korea are in possession of such machines, and emphasises their significance since "in any future hostilities ordinary measures and normal methods may well prove insufficient to cope with the situation."

These data are sufficient to clear up the apparent contradiction between the literature and the facts found in the field. They apply, at any rate partly, to all other insect-carried diseases, and help to explain the general tendency seen in Korea towards the use of insect vectors. The example taken is typical; we cannot limit the possibilities of bacteriological warfare to what has classically been observed in natural conditions; technical and scientific advances extend the range of what may be done, and throw light, as here, on apparent contradictions. An almost perfect control of insect vectors on the American side in Korea would invalidate the reservations found in the literature. For the same reasons the Commission cannot share the opinion of those who would assume that the diffusion of bacteria, viruses and toxins, in aerosols is the only effective method of bacteriological warfare. Thus Japanese experience (cf. p. 11 above) can now be utilised on a new level.

However, one of the cases examined by the Commission, that of the epidemic of encephalitis (SIA/3;8;00010) occurring in the cities of Shenyang (Mukden) and Anshan in Liaotung province, Northeast China (Manchuria), raised the possibility that a virus had been disseminated directly by the aerosol method. The Commission was unable to reach a

firm conclusion on the matter, since it could not establish a definite relationship between the disease and the air incursions. Nevertheless the evidence is indeed disturbing, and full documentation concerning it is therefore placed among the Appendices (FF, GG, HH & II).

The Commission is not in a position to give to the world concrete figures concerning the total number of Korean and Chinese civilians killed, nor the total morbidity, nor the fatality rate. It is not desirable that this should be done, since it would provide the last essential data for those upon whom the responsibility lies. The information is not necessary for the proof of the case upon which the Commission was invited to express an expert opinion. All that is necessary is to know what the Commission confirmed, namely that many human fatalities have occurred in isolated foci and in epidemics, under highly abnormal circumstances in which the trail always leads back to American air activity. It is essential that the world should take warning from what has happened and is still happening. All people should be aware of the potentialities of this kind of warfare, with its incalculable dangers.

MEMBERS OF THE INTERNATIONAL SCIENTIFIC COMMISSION FOR THE INVESTIGATION OF THE FACTS CONCERNING BACTERIAL WARFARE IN KOREA AND CHINA:

ANDREEN, Andrea: M.D. Ph.D. (Clinical and Laboratory Medicine) [Sweden]

(Signed)

MALTERRE, Jean: Ing. Agri. (Animal Physiology and Biology) [France]

(Signed)

NEEDHAM, Joseph: Sc.D. F.R.S. (Biochemistry, Embryology, Chinese Language and Literature) [U.K.]

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OLIVO, Oliviero: M.D. (Medicine, Biology and Anatomy) [Italy]

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(Signed)

Peking, 31st August, 1952.

CONCLUSION

Since the beginning of 1952, phenomena of a very unusual character occurring in Korea and China, led to allegations by the peoples and governments of those countries that U.S.A. forces were waging bacteriological warfare. The International Scientific Commission which was formed to investigate the relevant facts has now brought its work to a conclusion after more than two months in the field.

It found itself in the presence of a mass of facts, some of which formed coherent patterns which turned out to be highly demonstrative. It therefore concentrated its efforts especially upon these.

The Commission has come to the following conclusions. The peoples of Korea and China have indeed been the objective of bacteriological weapons. These have been employed by units of the U.S.A. armed forces, using a great variety of different methods for the purpose, some of which seem to be developments of those applied by the Japanese army during the second world war.

The Commission reached these conclusions, passing from one logical step to another. It did so reluctantly because its members had not been disposed to believe that such an inhuman technique could have been put into execution in the face of its universal condemnation by the peoples of the nations.

It is now for all peoples to redouble their efforts to preserve the world from war and prevent the discoveries of science being used for the destruction of humanity.

APPENDICES

TABLE OF CONTENTS

NOTE: The following conventions have been adopted for the titles of the documents here assembled. Statements of cases prepared by groups of Chinese and Korean scientists for the consideration of the Commission are termed **Reports.** These are sometimes followed by **Commentaries** on the case, prepared by the Commission. Records of the depositions and interrogations of witnesses, both lay and scientific, are termed **Notes** or **Hearings.** Written depositions of some length are listed as **Testimonies.** Material on various relevant scientific questions is assembled in **Memoranda.**

All Reports presented to the Commission by the Korean and Chinese specialists bear the index numbers ISCK/ and ISCC/ rsspectively, for convenience of reference, according to the country in which they were submitted.

In the notes of the **Hearings,** the questions asked by the members of the Commission are not given because they are implicit in the answers recorded. The questions are denoted by initial letters as follows:—

(A) Andreen, (M) Malterre, (N) Needham, (O) Olivo,

(P) Pessoa, (Z) Zhukov, (T) Tsien.

APPENDIX A

Chronological Summary of the Meetings of the Commission

Meeting 1. Peking, June 23, 1952.

—Formation of Preparatory Commission.
—Organisation of working schedule.
—Presentation of 5 memoranda (containing background information and comments prepared by European scientists).

Meeting 2. Peking, June 25, 1952.

—Election of temporary Scientific Secretary of the Commission.
—Report on Khabarovsk Trial.

Meeting 3. Peking, June 27, 1952.

—Presentation of a Chinese Report on biological warfare waged by Japanese in 1941—1943.
—Discussion on insects mentioned in Prague documents.
—Communication on biological containers reported by Mr. Burchett.

Meeting 4. Peking, June 28, 1952.

—Discussion on scope of work of the Commission.
—Discussion on last date of arrival for other specialists.

Meeting 5. Peking, July 1, 1952.

—Meeting with Chinese bacteriologists, general discussion on encephalitis, anthrax, plague, diphtheria, and typhoid.

Meeting 6. Peking, July 1, 1952.

—Inauguration of Full Commission and election of Permanent Scientific Secretary.
—Report on work of the Preparatory Commission.
—Comments on the laboratory findings of Chinese experts.

Meeting 7. Peking, July 3, 1952.

—Presentation of scheme for incidents analysis.
—Discussion on entomological abnormalities.

Meeting 8. Peking, July 5, 1952.

—Presentation of the subject of insects as carriers of diseases.
—Discussion.

Meeting 9. Peking, July 7, 1952.

—Discussion continued.

Meeting 10. Peking, July 9, 1952.

—Meeting with Chinese experts, general discussion on encephalitides.
—Report on discussions with Chinese phytopathologists.
—Discussion on identification of arthropods mentioned in Prague documents.
—Communication of studies on flies as germ carriers.

Meeting 11. Shenyang, July 12, 1952.

—Presentation by Dr. Wang Pin, Minister of Health, People's Government of Northeast China, of cases to be studied by the Commission.

Meeting 12. Shenyang, July 12, 1952.

—Report on Kan-Nan incident by Dr. Pai Hsi-Ch'ing, Vice-Minister of Health, People's Government of Northeast China.
—Fixing date for work in the bacteriological laboratory of the National Medical College, Shenyang.

Meeting 13. Shenyang, July 13, 1952.

—Hearings of 10 witnesses from Kan-Nan region.

Meeting 14. Shenyang, July 14, 1952.

—Reports by Chinese experts on Kan-Nan case.
—Discussion on trip to Kan-Nan.

Meeting 15. Shenyang, July 14, 1952.

—Further discussion on above.

July 15, 1952. Department for Kan-Nan

July 17, 1952. Back to Shenyang

Meeting 16. Shenyang, July 17, 1952.

—Résumé of data on Kan-Nan.

Meeting 17. Shenyang, July 18, 1952.

—Further discussion on Kan-Nan incident and on the re-examination of laboratory findings carried out at National Medical College, Shenyang.

Meeting 18. Shenyang, July 19, 1952.

—Discussion continued on Kan-Nan incident.

—Discussion on trip to Korea.

Meeting 19. Shenyang, July 19, 1952.

—Report by Dr. Pai Hsi-Ch'ing on K'uan-Tien incident.

—Presentation and discussion on the various types of containers for the dissemination of vectors.

—Discussion on relation between vectors and diseases.

—Hearings of witnesses.

Meeting 20. Shenyang, July 21, 1952.

Presentation of commentary on Kan-Nan incident and on K'uan-Tien container or bomb.

Meeting 21. Shenyang, July 22, 1952.

—Presentation of Liaotung and Liaohsi incidents.

—Report by Dr. Pai Hsi-Ch'ing on cases of respiratory anthrax and hemorrhagic anthrax meningitis and reports by Chinese experts.

Meeting 22. Shenyang, July 22, 1952.

—Discussion continued on anthrax cases.

—Hearings of 7 witnesses.

—Reports by bacteriologists.

Meeting 23. Shenyang, July 23, 1952.

—Hearings of 10 witnesses on Liaotung and Liaohsi incidents.

Meeting 24. Shenyang, July 23, 1952.

—Hearings of 6 witnesses on Liaotung and Liaohsi incidents.

Shenyang, July 24, 1952.

—Visits to the Departments of Bacteriology and Pathology of National Medical College.

—Examination of materials of anthrax cases.

Meeting 25. Shenyang, July 24, 1952.

—Presentation of the general subject of encephalitides.

Meeting 26. Shenyang, July 25, 1952.

—Report of Dr. Pai Hsi-Ch'ing on encephalitis cases.

—Report of Chinese specialists on the clinical, neuropathological, epidemiological and etiological aspects of the cases of encephalitis.

Meeting 27. Shenyang, July 25, 1952.

—Discussion and drafting of interim declaration before departure for Korea.

July 26, 1952. Departure for Korea.

July 28, 1952. Arrival in Korea, near Pyongyang.

Meeting 28. near Pyongyang, July 28, 1952.
—Discussion with Dr. Ri Ping-Nam, Minister of Health, Korea.

Meeting 29. Pyongyang, July 29, 1952.
—Report on epidemiology of cholera in Korea in the past.
—Presentation of Dai-Dong incident (cholera).

Meeting 30. Pyongyang, July 29, 1952.
—Reports of Korean bacteriologists and pathologists on the Dai-Dong cases (cholera).
—Hearing of 3 witnesses on Dai-Dong incident.

Meeting 31. Pyongyang, July 30, 1952.
—Presentation of Kang-Sou incident (plague).
—Hearing of 4 witnesses on Kang-Sou incident.

Meeting 32. Pyongyang, July 30, 1952.
—Report on Hoi-Yang incident (plague).
—Hearing of 2 witnesses on Hoi-Yang incident.
—Hearing of captured spy.

July 31, 1952—Visit to Laboratories in Pyongyang area.

Meeting 33. War Prisoners' Camp, August 3, 1952.
—Hearing of Lt. J. Quinn.

Meeting 34. War Prisoners' Camp, August 3, 1952.
—Hearing of Lt. F. B. O'Neal.

Meeting 35. War Prisoners' Camp, August 4, 1952.
—Hearing of Lt. Paul Kniss.

Meeting 36. War Prisoners' Camp, August 4, 1952.
—Hearing of Lt. K. Enoch.

Aug. 5, 1952. Leave Korea.

Aug. 6, 1952. Arrival in Shenyang.

Shenyang, August 7, 1952—Visit to Exhibition on Bacteriological War Crimes Committed by the U.S. Armed Forces.

August 9, 1952—Commission back to Peking.

Meeting 37. Peking, August 9, 1952.
—Discussion on editing of Report.

Meeting 38. Peking, August 10, 1952.
—Discussion continued on editing of Report.

Meeting 39. Peking, August 11, 1952.
—Discussion on Prague documentation.

Meeting 40. Peking, August 12, 1952.
—Discussion continued on Prague documentation.

Peking, From August 13, 1952 to August 30, 1952.
—Drafting the Report and assembling Appendices.

Peking, August 31, 1952.

—Signing of the Report by all members of the Commission.
—Press Conference.

Statistics of Witnesses Interrogated before the full Commission

Appendices		Laymen	Scientists	Total
H.	Phytopathology	—	5	5
J.	Entomology	—	3	3
N.	Kan-Nan	10	6	16
S.	Kangsou	3	4	7
U.	Hoiyang	2	3	5
V., W.	K'uan-tien	2	3	5
X.	Incident of June 6	1	0	1
Y.	Changp'ai	12	0	12
BB.	Liaotung & Liaohsi	24	5	29
FF., GG.	Encephalitis	0	6	6
DD.	Dai-Dong	3	5	8
JJ.	Agent	1	0	1
OO.	Airmen	4	0	4

Apart from the witnesses mentioned above, members of the Commission had the opportunity of talking either individually or in small groups to a large number of other witnesses.

APPENDIX B

General Survey on the Principles of Transmission of Diseases by Insect Vectors and Related Subjects

I. DISCUSSION ON THE IDENTIFICATION OF INSECTS*

1—*Lucilia sericata* (Meigen), Fam. *Calliphoridae*. There are 39 specimens of this species which is easy to identify. The identification of the genus is based on the work of Senior White, Aubertin and Smart: "Fauna of British India, Diptera." P. 27 Vol. VI, 1940. We know already that this genus is characterized by having three pairs of post-sutural dorsocentral bristles on the mesonotum and a smooth parafaciallia.

The species in question is no doubt the *sericata*. Professor Ch'en has specimens in his collection which help comparative studies. One of the assistants of Professor Ch'en has ready for print an article on the classification of the Chinese species of *Lucilia*. We are in agreement with the identification.

2—*Muscina stabulans* (Fallen). Specimens collected from many localities have been examined. Large numbers of specimens have been received. The identification of this species is very easy because it is very characteristic. It is not necessary to spend more time on the details of the taxonomy of this species because this fly is mentioned in all parasitology textbooks. We are in agreement with the identification.

3—*Musca vicina* Macquart. This species is closely related to *Musca domestica*. Only recently it was still considered as a variety of *Musca domestica*. The great difficulty in the differentiation between these two species (*M. domestica* and *M. vicina*) has been solved by Professor Feng in his article, "Morphological Studies of the Common House Fly, *Musca vicinia* in China." Peking Natural History Bulletin, Vol. 19, pt. 2-3, 1951, 278-284. We are in agreement with the identification.

* The verification of the various species of insects was carried out at the Parasitology Laboratory of the China Union Medical College through the help of Professors Ch'en and Feng. The Commission wishes to thank these professors for their friendly and helpful cooperation in this work.

4—*Tabanidae.* Professor Ch'en stated that the Medical College has not received specimen of tabanids.

5—*Tipulidae. Trichocera* sp. probably *maculipennis.* The identification was carried out according to the paper of Masaki and Tokunaga: "New or Little Known Trichoceridae from Japan (Diptera)". Tenthredo —Acta Entomolgica Vol. 2, 1938, page 39.

The Chinese experts were right in identifying it as *Trichocera* sp., because there were a few characteristics slightly different from *T. maculipennis.*

Professor Ch'en stated that he is not a specialist on this group but he has collections of tipulids for comparison. We are in agreement with the identification.

6—*Nycteribiidae*: The Parasitology Laboratory has no specimen of this group of insects.

7—*Plecoptera—Nemoura* sp.

This specimen has been identified by the famous Chinese expert Wu Chen-fu who is a great authority on zoology. He was Professor of Zoology of the Yenching University, Honorary Professor of The Fan Memorial Institute of Biology and Visiting Professor of Entomology in Cornell University. He has published important works on zoology, among which there is the "Catalogus Insectorum Sinensium" in six volumes. This Chinese expert has written a monograph on the Chinese Plecoptera.

The Commission agrees with the identification of this specimen because nowwhere else can we find an expert as qualified as Professor Wu on this work.

8—*Aedes koreicus* Edwards. Very common species. They were dropped at Tiehling by American planes and the specimens are now preserved in Shenyang and Tiehling. Professor Feng has also specialized on culicids and knows very well this group.

9—*Culex pipiens* var. *pallens* Coquillett. The identification of this common species is very easy. The only difficulty would be in the differentiation between this species and the *fatigans,* but the latter lives in tropical regions. The identification is to be considered as absolutely correct.

10—*Orthocladius* sp. The previous identification of this species as *Chironomus* cited in the Report of Democratic Lawyers is wrong, but in the later report of the entomologists, the generic name of this species is given correctly. As there is no Chinese specialist on this group and the *genus* has many species, we are satisfied with the generic identification.

11—*Helomyza* sp., probably *modesta* Meigen.

The identification of this species is based on the book written by Czerny, "Die Fliegen der Palaerarktischen Region." Stuttgart, 1925, Lieferung 53.

Professor Ch'en has been very careful in giving the probable identification as *modesta* for two reasons:

(1) because he acknowledges that he is not a specialist on this group,

(2) because he has no properly identified specimens of this species in his collection in order to make a comparison. The description of *modesta* by Czerny agrees with the specimens examined.

The Commission accepts the identification of *modesta* for the species in question.

12—*Hylemyia* sp. There are hundreds of specimens collected from many localities. We will find the general description in "Genera Insectorum, Diptera Muscidae," by Séguy. The specific identification is not yet done because Professor Ch'en has not yet collected all the literature on this subject. We are in agreement with the generic determination given by Chinese scientists.

13—*Collembola—Isotoma* sp. We are in agreement with the generic identification given by the famous Chinese scientist, Ma Shih-chun who has done a great amount of scientific work on *Collembola*.

14—*Arachnida*. There are numerous specimens of the genera *Lycosa* and *Tarentula*.

The identifications were made by the well known Chinese arachnologist Wang Feng-chen who has worked for more than ten years on this group and published several articles on the spiders. The Commission accepts as correct the identifications made by Wang Feng-chen.

15, 16, 17, 18. The specimens of *Pulex irritans* Linn. *Formica* sp., *Locusta migratoria* Linn. and *Acrydium* sp. are in Shenyang.

19. *Gryllus testaceus* Walker. Identified by the Chinese expert, H. F. Chu who has published together with L. Y. Wang, a study on the biology of this species and on their control "Life-history of the Field Cricket, *Gryllus testaceus* Walker (Orthoptera, Gryllidae) and Its Control." in Ann. Ent. Sinici 1951, I (3) 291-307.

We are in agreement with this identification.

II. INTRODUCTION OF ANIMALS INTO ZOO-GEOGRAPHIC REGIONS DIFFERENT FROM THEIR PLACE OF ORIGIN

The distribution of species on the surface of the globe exists according to zoo-geographical regions and is independent, at least for the present time, of climate. Thus it is revealed partly as a silent testimony of the changes happened in the topographic configuration such as the oceans, great courses of water, mountains and deserts which limit the free dispersion of animals.

The zoologists agree to acknowledge the following regions:

1. Palaearctic region for Europe, North Africa, North and Central Asia, Japan, etc.
2. Nearctic for North Mexico, United States and Canada.
3. Neotropical for South America, Central America and South Mexico.
4. Ethiopian for Africa south of the Tropic of Cancer.
5. Oriental for India, Ceylon South China, etc.
6. Australian for Australia.

The fauna of the various regions show differences between them. The countries having an identical climate but situated in the different zoo-geographic regions can possess very different fauna. But we know that vectors are transported constantly from one region to another. They can be dispersed by different natural or artificial means such as trains, boats, airplanes, winds, birds, etc. When a living vector is transported from its place of origin to another faunic region, three principal hypotheses of its possible results may be considered:

1. The vector will not survive.
2. It survives and it enters into equilibrium with the local forms.

3. It predominates and may upset the equilibrium among the fauna of the region.

We have the example of the second case in the cosmopolitan insects such as house flies and cockroaches (*Periplaneta americana, P. australasiae, Blattella germanica*), which can be found in all countries. For the third case, we have an example of *Aedes* (*Stegomyia*) *aegypti* undeniably autochthonous of Africa, introduced to America a little after its discovery, perhaps even by Christopher Colombus himself. In the hot countries of South America, it has greatly proliferated and has become the principal vector of yellow fever in these regions. Thus consequently it has been an obstacle to the development of Brazil for centuries.

In the African continent, there are various species of the subgenus *Stegomyia,* such as *A.* (*Stegomyia*) *africanus, A.* (*S.*) *luteocephalus, A.* (*S.*) *simpsoni, A.* (*S.*) *vittatus,* etc. which probably have been imported into America together with *A.* (*S.*) *aegypti.* Nevertheless, only the last species survived. We must also consider that *A.* (*S.*) *aegypti* is found in the African forests, but the tropical forests of America are free from these mosquitoes.

The introduction of *Gambusia affinis,* a kind of larvivorous small fish, into Italy illustrates well this example.

Originally of North America, it has been imported to the Peninsula for the biological prophylaxis of malaria. Very voracious, it mulptiplies with an extraordinary rapidity even in strongly brackish water and it destroys very rapidly the larvae of culicine mosquitoes. Due to its voracity and its great fecundity, it also disturbs the equilibrium of the aquatic forms. According to Sella, in Italy, the *Gambusia* developed abundantly in stagnant water, lakes and swamps where previously all sorts of larvae multiply rapidly, especially crustacea. In this manner, they have caused the destruction of the fauna and render the water nearly sterile. When it was proposed to introduce *Gambusia affinis* into Brazil as a biological procedure for the prophylaxis of malaria, some Brazilian zoologists had written against this initiative. One of the most eminent scientists, Von Hering, declared against this measure and suggested that, first of all, experimentation on the native species of Families Poecillidae (*Phallocerus caudimaculatus*) and Rivulidae should be carried out.

Accidental introduction of the African species, *Anopheles gambiae,* into the American continent was a very important event which is worth of attention. In the first place, it is because of the vast and murderous epidemics that it caused in Northeast Brazil, secondly it demolished the classical concepts about the geographical distribution of the vectors, and thirdly it indicates the possibilities of modifications of the

organism transplanted under the influence of a new environment. This example served as a proof to the hypothesis already provided by some scientists (Lutz, 1928) on the influence of the diffusion of vectors from one continent to another by the modern means of transportation. *Anopheles gambiae* is a very domestic species, very dangerous and probably most important vectors of malaria parasites in Africa.

It was discovered by the North American entomologist Shannon in 1930 in North Brazil (Natal, Etat de Rio Grande de Norte). In 1930 and 1931, this mosquito had already been captured 150 kilometers in the interior of the mentioned country. It constitutes a real vector of malaria, for in 172 dissected specimens, 68% have been found infected with malaria; 39% with sporozites in the salivary glands (Davis, in Soper and Wilson, 1943). In certain localities, such as Açu which had 37,000 inhabitants, more than 20,000 fell sick, of which 8,000 died.

We must notice the difference between the Brazilian species of vectors and imported *gambiae*. Generally autochthonous species had been found infected in the proportion of 8-10%. As to *gambiae*, as we have already seen, this proportion goes as far as 68%. In Brazil, *gambiae* is very domestic and hundreds of them were found in the interior of houses. On the contrary, the autochthonous species were discovered in small number in the inhabitation area. The *gambiae* is also very "anthropophile" and it bites man nearly exclusively. The American species have a less specialized habit. They bite man as well as animals.

The fight against the *gambiae* is very difficult and very expensive. But systematically combated in the larval stage as well as in the adult form, it had been exterminated in many regions. In other localities, its density diminished little by little until its complete disappearance in America in December 1940. Undeniably, eradication of *Anopheles gambiae* from the American continent had been one of the most brilliant sanitary victories of the Brazilian scientists. This happy example of the total extermination of an imported biological vector is a fact without precedent in history.

In summary one can say that the consequences of introducing a species into a new zoogeographical region are entirely unpredictable.

As to the importation of vectors the consequences can be the most baneful. Though some of the vectors may not survive, others can subsist and may even predominate over the autochthonous species. The case of *Anopheles gambiae* in Brazil illustrates well this respect.

Under new circumstances, they may occasionally present some biological and ecological modifications. The case of *Aedes aegypti* which

was sylvatic species in Africa but became an exclusively domestic species in South America, shows well this fact.

Consequently, in order to be efficient, attempts to introduce pathogenic germs into a new environment would include the use of many species of vectors. One cannot foresee *a priori* the chances of survival of the species introduced. One does not know beforehand if they are going to spread, disappear or be transformed.

III. ON THE SPECIFICITY OF THE VECTORS AND RESERVOIRS

As examples of the strict specificity between some parasites and their definite or intermediate hosts are already known in nature, there is a tendency to consider specificity as a general phenomenon. The parasites which would be intimately adapted to one single host or sometimes to closely related zoological hosts are called "stenoxenes". Examples which may be given are the different blood parasites, numerous intestinal protozoan parasites of the amphibians and cestodes of the birds.

As the transmission of different diseases caused by bacteria, rickettsiae and viruses was discovered one after another, the preconceived idea of specificity has led to the admission of one vector for each disease.

The same phenomenon is present when one considers the reservoirs of viruses which have been long considered as having a high specificity. Changes of opinions on specificity of virus vectors and reservoirs have become more extensive in recent years, as researches in the laboratories and epidemiological studies in nature on the etiology and transmission of infectious and parasitic diseases progress.

Yellow fever

In this connection, the example of yellow fever is the most interesting.

The transmission of this disease by *Aedes* (*Stegomyia*) *aegypti* was discovered by the Cuban scientist, Finlay in 1881 and for more than fifty years, it was believed that this mosquito was the only carrier of the disease. One may even read in the fifth edition of Brumpt's Treatise of Parasitology that "this disease may become endemic wherever the *Aëdes* vectors can live and come into contact with patient and then with healthy subjects". "The way of conservation of virus in nature is still difficult to explain as the blood of man is only infectious for the mosquito for 3-4 days. It is true that *Aedes aegypti* (*Aedes fasciatus*) keeps the virus for 16 weeks, and as this mosquito reproduces all the year round in the

tropical zones, there can be sporadic cases which make the area endemic."

The conception of the specificity of the vector (*Aedes aegypti*) and of the reservoir for the virus (only man) has been shaken up completely by the discovery of the susceptibility of certain Macacus (*M. rhesus* and *M. sinicus*) made by Stokes, Bauer and Hudson (1928). This discovery permitted the transmission of yellow fever in the laboratory through different species of mosquitoes belonging to several genera, and then the demonstration of the existence of naturally infected animals.

Thus the transmission in the laboratories by means of biting was obtained with the following species:

Aedes scapularis, Davis and Shannon, 1931.

Aedes fluviatilis, Davis and Shannon, 1931.

Haemagogus spegazzinii, Whitman and Antunes, 1938.

In Columbia also, naturally infected *Aedes leucocelaenus* were found. Manrique (1944) and Laemmert (1944) had verified that the virus is transmitted cyclically from *Callithrix penicillata and Leontocebus chrysomelas* or from the species of the genera *Alouetta* and *Cebus* and from the genera *Marmosa* and *Metachirus* by the wild species of mosquitoes, *Haemagogus spegazzinii, H. spegazzinii falco, Aedes leucocelaenus, Aedes scapularis* and *Aedes fluviatilis.*

Already in 1933, Hindle (Trop. Diseases Bulletin, XXX, pp 278-290) has published a list of animals susceptible to the virus of yellow fever, which included not only the macacus, but also insectivora *Erinaceus europaeus* and rodents, such as guinea pig (*Cavia porcellus*), rat, white mouse, *Sciurus vulgaris, Microtus agrestis* and many others.

In the case of certain domestic animals such as cat and dog, the virus can survive in the blood for several days.

With respect to vectors, the same author has published a long list of mosquitoes belonging to the *Eretmopodites, Culex, Wyeomyia, Haemagogus, Taeniorhynchus,* etc. which transmit the virus by biting or by inoculation. Of these some are South American, some are African and still others are from non-endemic regions of North America and Europe.

In the following we give a list of other principal species which can transmit yellow fever virus from one animal to the other:

Africa:

Aedes (Stegomyia) metallicus
„ *(S.) africanus*
„ *(S.) luteocephalus*
„ *(S.) simpsoni*
„ *(S.) vittatus*
„ *(Aedimorphus) stokesi*
„ *(Diceromyia) taylori*
Eretmopodites chrysogaster.
Taeniorhynchus (Mansonioides) africanus
Culex thalassius

South America

Aedes (Ochlerotatus) scapularis
Aedes (Finlaya) leucocelaenus
Aedes (Taeinorhynchus) fluviatilis
Haemagogus spegazzinii
Haemagogus spegazzinii falco

North America

Aedes (Finlaya) triseriatus
Aedes (Taeniorhynchus) taeniorhynchus

Europe

Aedes geniculatus

Finally, it should also be stated that the vectors of the yellow fever virus is so weakly specific that Davis (1933) and Aragao (1933) demonstrated that the ticks *Amblyomma cayennense, Ornithodorus rostratus* and *O. moubata* can transmit the virus, either by means of biting or by injection of ground material. Thus the idea of strict specificity of the reservoirs and of the vectors—man and *Aedes* (*S*) *aegypti*—changed to the conception of multiplicity for both. This shows the danger of formed ideas and of theoretical generalization. Only prolonged experimental studies permit one to make a decision.

We should notice here that yellow fever virus does not usually present the tendency of mutation.

Encephalitis

The studies of encephalitis and of the equine encehalomyelitis recently accomplished show well the non-existence of specificity,

for the transmitter as well as for the host. A very large number of species of mosquitoes including *Culex tarsalis, C. pipiens, C. tritaeniorhynchus, Aedes dorsalis, A. lateralis, A. taeniorhynchus, A. vexans, A. nigromaculatus* have been accused of being vectors of encephalitis of St. Louis type.

The dog's tick *Dermacentor variabilis* can also transmit the virus experimentally; *Triatoma sanguisuga* has been found naturally infected with the virus of Western equine encephalomyelitis.

Finally, the chicken mite (*Dermanyssus gallinae*) transmits the virus to the fowl. As to the reservoirs, the principal ones are the birds, not only domestic but also the wild birds, in reality all the birds are susceptible, and young ones are more easily infected than adults.

We found also in nature infections of horses, mules, oxen, pigs, dogs as well as large numbers of wild animals such as gray rats, black rats, rabbits, etc.

The virus is readily infectious for laboratory animals, such as guinea pig, white rat, hamster, etc.

We see from these examples how the virus of various types of encephalitis can be transmitted to the different species of animals; their vectors belong to several orders. As the virus of encephalitis has a marked tendency toward mutation, one understands how the very virulent virus with variation of vectors and hosts can be obtained and used by the war criminals as a bacteriological weapon for annihilating mankind.

Rickettsiosis

The diseases caused by rickettsia are very large in number, but here we are going to consider only epidemic typhus and murine typhus, caused by *R. prowazeki* var. *prowazeki* and *R. prowazeki* var. *mooseri* respectively.

According to the works of Castaneda (1930), Mooser, Varela and Pilz (1934) and others, the transformation of epidemic typhus rickettsia into murine typhus rickettsia is obtained by passage through animals. This, to certain authors, shows the fundamental unity of typhus rickettsiae.

One should consider in this case not only the lack of strict specificity of the organism but also its transformation in accordance with different vectors and reservoirs. Although not long ago, this view could hardly be accepted.

It is interesting to observe that Lewthwaite and Savoor (1938) related the mutation of murine typhus, of the type Proteus X19 to XK, through the passage in *Xenopsylla cheopis*. If it is true that the passage

through the reservoirs or the vectors, in general, does not determine its specific or racial mutation; this mutation, however, can be obtained in certain particular and well studied instance. We have, as an example, the transformation of variola virus into vaccinia virus through the passage in the lower animals. It is already known that smallpox is a disease of human origin. Ordinarily, it is transmitted directly from man to man. It can, however, be transmitted by inoculation of a great number of animal species in which this disease develops with benign character and is usually localized. When the virus is adapted to animals, it loses a great deal of its virulence to human being and when it is reinoculated into human-being, it causes a benign lesion as by vaccination.

The vaccine confers to man immunity against smallpox. So the transmission of smallpox virus to cattle induces this mutation and its transformation into virus of vaccinia. It is interesting to remark that we are still not able to produce the inverse case, that is to say the transformation of vaccinia virus into smallpox virus.

Passive vectors of the pathogenic organisms.

Great numbers of pathogenic organisms can be transmitted mechanically from the reservoir or from the sick man to a healthy man.

The microbes can be found on the exterior chitinous surface or in the interior of the arthropods. In this case, they can live in the digestive tube, in the hemocele, in the Malpighian tubules, etc., thus the arthropods behave as very efficient disseminators of germs.

They adhere also on the exterior surface, on the scales, wings, legs and wherever adhered they have the possibility of increasing the power of dissemination.

According to Steinhaus (1942-Catalogue of Extra-cellular Bacteria Associated with Insects and Ticks) nearly 250 species of bacteria associated in some form with insects and ticks were identified. Among them the author did not include intracellular rickettsia and "symbiotes".

Similarly, the blood sucking flies can spread with great efficiency the pathogenic bacteria which form spores. This is the case of anthrax caused by *Bacillus anthracis* which forms spore.

The blood sucking flies can spread anthrax not only from sick animal to healthy animal but also from animal to man.

Graham-Smith demonstrated that the larvae of flies ingested the spores of anthrax and became infected adults. Furthermore, the blood

sucking flies can disseminate *Bacillus anthracis* and their spores are found on the external surface and in the feces. Man and animal can be infected when these spores are deposited in the wound of skin.

The cholera vibrio is also much more resistant and can live for several days on the ground and for months in water.

Still more recently, scientists continued to consider the non-biting flies as the most important vectors of poliomyelitis.

The experimental transmission of poliomyelitis, using ground-up material of flies captured in places where there were cases of poliomyelitis, was succeeded by different authors. Paul (1941), Sabin and Ward (1941) demonstrated that food, exposed to flies in houses where there are children suffering from poliomyelitis and given to chimpanzees, produced poliomyelitis in these animals.

One may then consider that other neurotropic virsuses as those of encephalitis, may be spread in the same way.

The spreading of several other species of microbes such as the bacilli of plague, tuberculosis, and leprosy, the virus of smallpox, etc., by flies is very little studied. There is no doubt, however, that the flies as well as many insects such as cockroaches, spiders, etc. which frequent houses should have a very important role in their dissemination.

IV. ARTIFICIAL BREEDING AND INFECTION OF VECTORS

General Considerations

For the development of the knowledge of transmission of infectious and parasitic diseases, it is necessary to have artificial breeding of various species of vectors as well as their artificial infection in the laboratory.

It is equally necessary that artificial infection of vectors should give very high percentages of success.

In the artificial breeding of vectors, the methods and technic should be efficient and simple in order that a great number of arthropods may be obtained with a minimum of work.

Artificial infection should be carried out by the most cautious procedures so that infection with the most virulent germs could give the highest percentage of positive results, and these procedures should be carried out with due precautions so as to safeguard all the workers.

As soon as the artificial breeding and infection of arthropods with bacteria, rickettsia and virus are completed, a large stock should be built up for future use when required. It is impossible to know the methods of artificial breeding, infection and storage of insects carried out by a country waging bacterial warfare, as they are kept secret not only for the purpose of producing bacteriological weapons, but principally because they are against humanity.

It is easy to understand that there is no difficulty in carrying out the various steps of this work. Bacterial warfare criminals have derived their knowledge from studies in artificial breeding and infection of vectors originally intended for medical purposes with the aim of fighting diseases for the sake of humanity. The treatment of general paralysis by malarial parasites, protozoa of the genus *Plasmodium* is an example.

The treatment can be done in two different ways:

1) Inoculation of a patient suffering from general paralysis with the blood of someone infected with *Plasmodium* and consequently with the parasites in the blood;

2) Transmission of malaria to the general paralysis patient through the medium of infected anopheles.

It has been demonstrated that the second method is more efficient and gives a higher percentage of cure and improvement. Thus it is required to breed anopheles on a large scale and carry out the artificial infection, to build up a stock and to devise ways of transportation for use whenever wanted. All these problems have been solved by scientists in many countries. Artificial infection of the anopheles is obtained by feeding them on human cases of malaria or on monkeys infected with *Plasmodium knowlesi*, this last species of parasite is particularly well suited in the treatment of general paralysis.

The preservation of the infected mosquitoes has been effected at low temperatures, something like an artificial hibernation of these mosquitoes. They can be sent to any required destination, even for long distances or to a hospital. Once arrived, the mosquitoes are placed in surroundings of 25° to 27° C. and as soon as they are awakened from their sleep, they will bite the paralytic patient with great eagerness, who gets the infection with the *Plasmodium* used as a therapeutic agent.

By this example, it is obvious that human intelligence can solve all the difficulties relating to the special case of inoculated malaria.

It can also solve the difficulties when the use of infected vectors is required for the criminal action of bacterial warfare.

Artificial Breeding of Nematocerous Diptera

Anophelines. As already mentioned, breeding of various species of anophelines is easily done in the laboratory. In the Parasitology Laboratory of Sao Paulo University, breeding is carried out on a vast scale of Brazilian species of anophelines, malarial carriers, such as *Anopheles* (*Nyssorhynchus*) *albitarsis domesticus, A.* (*N*). *argyritarsis, A.* (*N.*) *tarsimaculatus, A.* (*N.*) *strodei,* etc.

Under laboratory conditions, these species are reared very easily in cages of 40 x 40 x 70 cm. and even in smaller ones.

The optimum temperature is 21-23° C. and relative humidity is 95% (A. Galvao et al 1944).

Larvae are fed on *Paramoecium* and other smaller infusoria, and bacteria which develop abundantly in wheat infusion.

In order to have good eggs, the females must rest at night. Females are fed on human blood or on guinea-pigs, but just as the males, they also need sweet food. Mating takes place in the first 48 hours of the anopheles life, and usually happens immediately after twilight when mosquitoes start flying. Females lay their eggs on water in petri dishes placed in the cage. These eggs can be removed in great numbers every day and from these eggs, new breeds are started. Each female can lay more than 200 eggs; one *A. albitarsis* female lays in 3-4 batches, a total of 250 to 280 eggs and survives for a month in the laboratory on 12 feedings.

Galvao (1945) has observed 2 females of *A. albitarsis domesticus* giving 8 to 9 egg layings. Bruce Mayne (1922) in the United States managed to keep for 231 days *A. punctipennis* at a temperature varying from 7-24°C. The average period of survival for 85 individuals was 90 days, eight of them lived for 175 to 203 days. The same worker managed to keep *A. crucians* for 65 days and *A. quadrimaculatus,* 73 days.

Eggs can be preserved for many days at a temperature of -3° C., those of *A. quadrimaculatus* can thus be kept for 15 days. At low temperatures, the eggs stop their development and remain in latent life and can thus be stocked and when placed again at a temperature of 20-25° C., they can development well. The same methods can be applied successfully to the breeding of many species of anophelines.

The North Americans carry on a large scale breeding of *A. quadrimaculàtus, A. punctipennis, A. crucians* etc. (Boyd, 1926, 1930, 1937).

Anophelines are very adaptable to artificial surroundings and after a few generations, breeding can be done in small cages. As soon as an artificial breed has been adapted to the conditions, the colonies require no other care except providing blood as food.

A small laboratory can always at all times keep nearly 5,000 anophelines in breeding. For building a stock of females, they must be placed in an incubator of 20-22° C. for 2-3 days so that the blood may be digested and then they are stored in an ice-box until required. In 1936, an American worker described a thermo-insulated container for the transportation of adult insects.

Culicines. The culicines are in general easily bred in the laboratories. The species most frequently studied because of their medical importance are the *Aedes* (*S*) *aegypti, Culex fatigans,* C. *pipiens.*

The breeding of *Aedes,* as for *Culex,* is carried out on the whole in the same way as that for anophelines, the only difference is that it is still easier. The *A. aegypti* are easily made to feed on monkeys and they multiply abundantly, even in small cages. They live for 150-200 days in the laboratory. The males live for a shorter period. Very often the culicids and even the anopheles refuse to feed in captivity. Nevertheless, it is easy to make them take the blood or cultures (in case of artificial infection) by introducing their proboscis between two slides covering the food or by using capillary tubes (Hertig, 1927).

Each female of *A. aegypti* can lay 70-150 eggs in many layings. The eggs are very resistent and can be kept dry for 6-8 months. The larvae develop very quickly in dirty water where they seem to feed on bacteria. Trager (1935) managed to cultivate larvae in a medium without bacteria by using liver extract and Fleischmann yeast. Under laboratory conditions, breedings can be obtained in all seasons.

C. fatigans can also be bred very easily in the laboratory. The cages used are of the same dimensions as those used for anophelines. According to Huff (1936), the greatest difficulty found in breeding *C. pipiens* was the difficulty of fertilizing the females in the first generation when usually sterile eggs are laid. There is no such difficulty with the *C. fatigans* by using large cages. This species can be fed solely on fruit juice. However, they must be made to bite laboratory animals and birds so that succeeding generations will bite

man and other animals. The larvae are very easily bred in water to which has been added a large variety of food such as dehydrated serum, bananas and coagulated milk, etc. When females need be separated from the males, ether can be used as anaesthetic and a pair of small fine forceps is used to pick out the females (Huff, 1936). When used carefully, ether has no harmful effects on these insects.

Family Psychodidae. Insects of this family look like small moths. They also look like mosquitoes from which they can be distinguished by their oval wings and hairy body. The larvae live on decaying vegetable substances. The species of the genus *Phlebotomus* bites man. The Phlebotomus transmits to man, three-day fever (pappataci fever)—a virus disease, oriental sore, American forest leishmaniasis, visceral leishmaniasis and verruga.

These are small insects measuring 1.5 – 3 mm. in length. Since 1927, the technic of breeding *Phlebotomus* has been improved by many workers in Europe, Africa, India, China and Brazil (Barretto, 1941), and with due care on the rqeuirement of the species concerned we can obtain numerous adults from the various species for experimental purpose. These insects are found in all parts of the world.

Family Simuliidae. Flies belonging to this family have a hunchback appearance, the back being oval and bulging. These insects are found in all parts of the world where there is natural or artificial running water which is an essential condition for their larval development. The larval development can only take place in well aerated waters, that is, in running waters. The complete breeding of two species of *Simulium* (*S. aureum* and *S. erythrocephalum*) was first achieved by Puri (1925) who made use of the aquarium, the water of which is filled with small green algae and the aeration is carried out by means of a special small pump. At Sao Paulo in Brazil, D'Andretta has succeeded in breeding numerous Brazilian species.

Family Tipulidae. The artificial breeding of tipulides was first carried out and described by Rogers (1937) in the United States. The breeding was carried out with larvae or females captured in the field. According to their nutritional requirements, he classified them into five groups. The first includes species which need mushrooms for their breeding and they are the easiest to breed. He managed to get 4-12 successive generations of *Limonia cinctipes, L. macateei* and *L. rara.*

The larvae of the second group live in sand and moist earth. He managed to breed them with green algae; if carnivorous species are bred, the larvae must be fed with annelid worms or other small animals.

The third group includes species which live in pools of which few species have been cultivated.

In the fourth and fifth groups which include aquatic or semi-aquatic species; numerous species were bred in the laboratory.

Artificial Breeding of Flies

Family Syrphidae. Dolley (1937) succeeded in breeding the fly *Eristalis tenax,* which is very common in our gardens. They were kept in cages of 15 x 15 x 15 cm. and fed with pollen, sugar and *Eschscholtzia californica* powder. Under such nourishing conditions, the adult flies have the optimum of living conditions and lay fertile eggs. The eggs hatch and the larvae develop in human feces mixed with earth. Each female lays over 3,000 eggs, the larval stage lasts two weeks and the pupal stage 8 days under the temperature of 22° C.

Family Calliphoridae. *Lucilia sericata.* Numerous species of this family have been successfully bred in the laboratory.

The procedures used for the breeding of *Lucilia sericata* can also be used for the breeding of other species of this family, for example, *Calliphora erythrocephala, Cynomyia cadaverina* and *Phormia regina.* Cousin (1929) is an authority on this subject and has published many articles concerning the breeding of *Lucilia sericata.*

An isolated fertilized female will lay during its 35 days of fecundity approximately 1,000 eggs. These will hatch in a few hours at 25° C. (Cousin, 1929). In order to obtain larvae meant for the upkeep of continuous breeding, it is only necessary to place the eggs on a piece of meat, liver or spleen in a container covered with a piece of cloth in order to prevent contamination by other flies. The mature larvae will migrate from the spot where they develop and will look for a favorable spot to transform themselves into pupae, and under favorable conditions, the larvae will all transform into pupae in a few days, and the first adults will come out about 7 days later. This species will multiply in an incubator of 25° C.

As the larvae of *Lucilia sericata* had been employed in the treatment of osteomyelitis, methods of breeding these larvae under aseptic conditions have been described. The eggs deposited by *Lucilia* should be separated with a small brush and then sterilized in 10% formalin solution for three minutes. They were then placed in a tube of sterile medium and incubated at 25°C. After 48 hours they can be used by surgeons to be deposited on the wounds.

Family Muscidae. Progress has been achieved recently in the breeding of *Musca domestica* and of other close species.

The house fly was bred at first in horse feces, and later on through the work of Glaser (1927) and Grady (1928), the technic was improved. Richardson (1932) used wheat bran, alfafa, yeast and maltose. With such a method, the breeding of *Musca domestica* and *Musca vicina* and other species have been carried out on a large scale.

We can build up a large stock of adult flies by feeding them with diluted milk. In a room of 8 x 12 feet, over 2,000 flies can be bred every day. The flies can be stocked at temperature of 4-5° C. When they are brought to normal temperature again, their normal activities are resumed.

Muscina stabulans has been bred in the laboratory with identical methods as those used for the *Musca domestica* (Grieve, 1937).

Family Anthomyiidae. The genus *Hylemyia* includes a large number of species whose larvae are saprophagous, phytophagous, coprophagous, carnivorous, etc. The breeding of some of these species in large quantities is very simple and easy.

Breeding of Lice

It is easy to breed the human louse, *Pediculus humanus corporis* as well as other lice of mammals, such as the pig louse, *Haematopinus suis*.

Pediculus humanus corporis can bite mammals and the hen, but it cannot reproduce and develop normally unless it feeds on human blood. Guinea-pig blood is toxic for this louse.

We can also breed the pig louse on man. However, it will not reproduce and develop normally unless it sucks the pig's blood.

In laboratory studies, the existence of a symbiote was demonstrated when the louse sucks the blood of its normal host. Such symbiote disappears if the insect has sucked the blood of an abnormal host. We can therefore guess that there is in existence an intimate relationship between the ingested blood and the presence of the symbiote which renders the breeding of such insects on abnormal hosts impossible.

For the breeding of the human louse, the insects are placed in small wooden or bony cylinders, closed at each end with thin silk and maintained on the skin by leather straps. They can be placed on the forearm, on the leg, or on the calves of volunteers.

Artificial infection of lice with rickettsia of epidemic typhus can be done easily through the rectum. Injecting into the rectum of the louse is made with materials obtained from the digestive tract of the infected louse or from the nervous tissue of a mammal such as the guinea-pig. By the use of such a technic, *Rickettsia prowazeki* of epidemic typhus can be transmitted indefinitely from louse to louse and a large number of lice can be infected. There is also the possibility of passing the germ to the guinea-pig or to the monkey and to return it again to the louse.

We can equally take out the intestine of the infected lice, grind the material, dry it and thus obtain a large quantity of dried virus which remain active for many months.

Breeding of Fleas

In the breeding of fleas, the temperature is very important. The development is very much accelerated by the elevation of the temperature; thus the larval stage may vary from 9 to 202 days and the pupal stage from 7 to 239 days (Bacot 1914).

In comparison with other insects, fleas have very long lives. According to Bacot (1914), the life of several species of fleas is given as examples in the following:

	Nourished	Un-nourished
Pulex irritans—human flea	513 days	125 days
Nosopsyllus fasciatus—rat flea	106 „	95 „
Xenopsylla cheopis—rat flea	100 „	38 „
Ctenocephalides canis—dog flea	234 „	58 „
Ceratophyllus gallinae—fowl flea	359 „	127 „

The human flea can lay more than 500 eggs during its whole life.

The breeding of fleas in the laboratory is very easy and does not need any special apparatus.

In Sao Paulo, Brazil, Pessoa (1951, p. 678) has studied the breeding of the rat flea, *X. cheopis and X. brasiliensis.* The larvae were fed with dried human or rat blood.

In the following table, we give the time of development of the two species at S. Paulo.

Development of *X. cheopis* and *X. brasiliensis* in Saò Paulo, Brazil.

	X. cheopis		*X. brasiliensis*	
	summer	winter	summer	winter
eggs	2-5 days	7-8 days	2-5 days	7-8 days
larvae ..	20-22 days	32-34 days	22-24 days	34-36 days
pupae ..	4-8 days	25-30 days	4-8 days	25-30 days
adults ..	26-35 days	64-72 days.	28-39 days	66-74 days

If we multiply the number of incubators, we shall be able to obtain billions of these insects which can be stocked for a long period until the appropriate moment.

We see in consequence how the Japanese could carry out their breeding and disseminate a large amount of these insects over enemy territories.

We may first of all quote from the the Khabarovsk Trial—Materials on the Trial of Former Servicemen of the Japanese Army Charged with Manufacturing and Using Bacteriological Weapons, Moscow, 1950 (Foreign Languages Publishing House)—the following lines which are very illustrative (p. 400).

"Detachment 731's production potential of fleas was determined by its possession of 4500 "flea nurseries" (incubators) which served the purpose of breeding fleas. These incubators made it possible in short periods of time to obtain scores of kilograms of fleas, equal to many tens of millions in number, which were infected with plague with the object of using them as bacteriological weapons."

"The actual 'output' of Detachment 731 equalled 45 kilograms of fleas in the course of 3-4 months. It must be noted that, on the average, 45 kilograms of fleas could contain about 145,000,000 specimens of these parasites."

Breeding of Ticks

Because of the necessity for a massive production of vaccine against the Rocky Mountain spotted fever and against exanthematic fever of Sao Paulo (Brazil), both of which are Rickettsial diseases and are transmitted by ticks, one can accomplish today with great ease the cultivation of ticks on a large scale. In the United States, the Rocky Mountain Laboratory carried out cultivation of great numbers of *Dermacentor andersoni* and in Sao Paulo, the Institute of Butantan, also carried out large scale cultivation of *Amblyomma cayennense.* We shall not go into details about the methods of artificial cultivation of these arthropodes, which are well known and are published in books specialized on the subject in question. It is necessary, however, to call attention to the fact that ticks so cultivated can be kept in stock for one year or more in glass tubes. During this period, they are conserved at a temperature of 6°C and a relative humidity of 80%.

Breeding of Spiders

Baerg (1937) described the method of cultivation of tarentule spiders of the species *Eurypelma californica.* The young spiders are nourished on small insects. Termites are suitable insects for the nourishment of the young spiders until the latter reach 3 years old. The adult spiders are nourished on locusts, cockroaches, crickets and various caterpillers, etc.

The spiders of the species *Eurypelma californica* feed once a week, and those of the genus *Dugesiella* (*Dugesiella crinita*) feed more frequently and take more food. The adult spiders can live entirely without food for more than two years. But they are less resistant to the shortage of water. It is therefore necessary to have always water in the incubator, because without water, they will die within two months.

The female lays a large number of eggs which in normal conditions give birth to 600-1200 young tarentules.

Breeding of Collembola

Macnamara and Spencer (1924) have described the procedure for the cultivation of Collembola. They are animals very sensitive to the lack of water. In captivity, they need always sufficient humidity. They can be bred in a container with pieces of moist paper.

It is necessary also to carry out the cultivation with the container always closed because the young ones are sensitive to the air current. The females lay a large number of eggs.

The alimentation of the Collembola varies according to the species. *Isotoma palustris* feeds on algae, while other species such as *Anurida maritima* is carnivorous and feeds on mollusca. The colonies are easily maintained for many years, when the food and humidity are suitable.

Breeding of Plecoptera

In the book published in North America "Culture Methods for Invertebrate Animals." (1937) are quoted the work of the Chinese scientist Wu Chen-fu on this question. This scientist is the person who identified the genus *Nemoura* sp. (Plecoptera) among arthropods dropped by American planes in Korea. According to Wu Chen-fu, the *Nemoura* are herbivorous and can survive without food for several days. The cultivation of Plecoptera is carried out by very simple processes.

The nymphs are conserved in vases containing moist leaves until they hatch into adults. After one week, mating takes place and several days later, the females begin to lay their eggs.

Breeding of Coleoptera

The artificial cultivation of Coleoptera, has been described in the "Culture Methods for Invertebrate Animals." We give in the following a list of the principal families in which various species have been cultivated:

Carabidae, Haliplidae, Gyrinidae, Hydrophilidae, Silphidae, Staphylinidae, Pselaphidae, Elateridae, Helodidae, Dermestidae, Erotylidae, Coccinellidae, Tenebrionidae, Cisidae, Scarabaeidae, Passalidae, Cerambycidae, Chrysomelidae, Mylabridae, Curculionidae, Scolytidae.

V. GENERAL ENTOMOLOGICAL CONSIDERATIONS

1. Mosquitoes and Flies

General considerations

The report of the Chinese scientists refers to mosquitoes and flies.

Mosquitoes and flies are very different in their morphology, ecology, biology and in their capacity of transmitting diseases. Mosquitoes are inferior Diptera, while flies are superior Diptera. The larvae of mosquitoes, which almost entirely live in water, have readly visible heads (cephalic larvae). The larvae of flies, generally found in decomposed substances, are acephalic.

The adults, which originate from cephalic larvae, come out through a T-shaped slit on the cephalic end of the pupal skin of the nymphs, and they have no frontal ampule (ptilinum) at the moment of emergence; they are Dipterae Orthorhapha (Tabanidae, Culicidae, etc.).

The adults, which originate from acephalic larvae, come out through a circular orifice of barrel-shaped puparium. The circular orifice is produced by the pressure of the frontal ampule on the two valves of dehiscence at the anterior end of the puparium. They are Dipterae Cyclorrhapha (Muscidae, Oestridae, etc.)

Flies are characterized by short, three-segmented antennae, stocky bodies and broad wings (Brachycera). Mosquitoes have slender body and filiform antennae of several segments (Nematocera).

A. Mosquitoes

Mosquitoes of the family Culicidae possess considerable importance from the medical point of view. They are the vectors transmitting to man malaria, filariasis, yellow fever, dengue fever, encephalitis, etc. They also play a very important role in the mechanical or biological transmission of other diseases.

For the moment we shall not approach the questions of malaria and filariasis because they are generally chronic diseases with low mortality rates. We shall proceed to discuss a question that is more important for us. It deals with the transmission of encephalitis by mosquitoes. The arthropod-borne encephalitis comprises a group of diseases caused by closely related viruses. Birds are possibly the natural hosts of most of these types of viruses, but many other animals in nature may be

infected. The usual vectors are mosquitoes and ticks. We must not confuse the encephalitis transmitted by arthropods with encephalitis of type A (Economo type) which only afflicts man and is not transmitted by arthropods.

The group of encephalitis transmitted by arthropods comprises the following types, but there are other less well known types and probably many others not yet identified:

Encephalitis, St. Louis type.
Encephalomyelitis, Western equine.
Encephalomyelitis, Eastern equine.
Encephalomyelitis, Venezuela equine.
Encephalitis, Japanese type B.
Encephalitis, Russian spring-summer.
Louping ill.

All the above mentioned types of virus encephalitis transmitted by arthropods produce in man diseases of very similar clinical symptomatology, differing only in their severity and mortality rate. The onset is sudden with fever, chills, headache, nausea, pain in the neck and the whole body. The patient becomes somnolent, and in certain cases may enter into coma. The mortality rate may reach 75% in eastern equine type of encephalomyelitis, or 60% in the Japanese type B. Venezuelan encephalomyelitis and louping ill are more benign, since they do not cause death. The western equine encephalomyelitis tends to afflict adults; in the United States and Canada alone there were 3,000 cases in 1951. The virus of the eastern equine encephalomyelitis almost always afflicts children with a high mortality rate; and a part of the children who survive, manifest sequelae such as paralysis and mental disturbances.

The viruses of encephalitis are in general very similar but immunologically different. Nerve tissue containing the virus preserved in 50% glycerine remains infectious for one year in the deep freezer, while it keeps still longer in the lyophilized state. A great number of mosquitoes are involved in the transmission of the virus of encephalitis; ticks, triatomids and mites are also important vectors.

A table of Hull (1947) showing the various species transmitting encephalitis is given herewith.

Arthropod Vectors of Encephalitides Virus

	Western Virus	Eastern Virus	Venezuelan Virus	St. Louis Virus	Japanese B Virus	Russian Autumn Virus	Louping Ill	Russian Spring-Summer Virus
Mosquitoes								
Aedes aegypti	+	+						
Aedes albopictus	+			+	+*	+*		
Aedes cantator	+	+						
Aedes atropalpus		+						
Aedes dorsalis	+			+				
Aedes japonicus					+*	+*		
Aedes lateralis				+				
Aedes nigromaculis	+			+				
Aedes taeniorhynchus	+	+	+	+				
Aedes vexans	+	+		+				
Aedes solicitans	+	+						
Aedes togoi					+*	+*		
Aedes triseriatus		+						
Anopheles maculipennis freeborni	+*							
Anopholes neomaculipalpus	+		+					
Culex pipiens	+*			+				
Culex pipiens var. pallens	+	+		+	+	+		
Culex stigmatosoma	+							
Culex tarsalis	+			+				
Culex tritaeniorhynchus		+		+	+	+		
Culiseta incidens	+							
Culiseta inornata	+							
Mansonia tittilans			+					
Ticks:								
Dermacentor andersoni	+							
Dermacentor silvarium								+*
Dermacentor variabilis				+				
Haemaphysalis concinna								+*
Ixodes persulcatus								+
Ixodes ricinus							+	
Assassin bug:								
Triatoma sanguisuga	+							
Mite:								
Dermanyssus gallinae	+			+				

* Laboratory vector but not proven to be a vector in nature.
Note: Russian Autumn Virus=Japanese B Virus.

Birds may be the animal reservoirs of these viruses; chickens are most important from the epidemiological point of view. The resistance of the chickens varies with age; chicks are more easily infected. In Yakima (Washington), Hammon et al in 1945 verified that 30-50% of chickens below one year of age are infected with the virus of eastern equine encephalomyelitis.

Other fowls like duck, goose and turkey may be infected in nature. Other natural reservoirs are cattle, pig and dog. Several other kinds of birds and domestic animals are also common reservoirs.

Transmission of the virus among chickens is brought about by chicken mites (*Dermanyssus gallinae*). After biting the infected fowls, the infected mosquitoes may then transmit the disease to man. This kind of transmission is not mechanical, but it takes place after multiplication, maturation and perhaps cyclic mutation of the virus in the body of the mosquito (Kelser 1933).

The conservation of the virus in the chicken mite is indefinite, because the transmission is transovarian.

Man and other domestic animals can be infected by the bite of chicken mite, which is probably the principal vector of the virus of the equine type of encephalomyelitis.

Forest tick (*Dermacentor andersoni*) and dog tick (*Dermacentor variabilis*) can be infected and transmit the virus of Western equine encephalomyelitis to susceptible animals. The infected tick can carry the virus through several generations, because the female transmits it through the eggs (Syverton and Berry, 1941).

Triatomids (*Triatoma sanguisuga* of North America) are found to be naturally infected with the Western equine encephalomyelitis virus (Kitselman and Grundmann, 1940). Tick (*Ixodes ricinus*) is the responsible vector of louping ill in England. The larvae of ticks get infected when they bite sheep, and their nymphs are capable of infecting healthy sheep. If the nymph is infected, the adults will also be able to transmit the infection (MacLeod and Gordon, 1932). Tick (*Ixodes persulcatus*) is the vector of Russian spring summer encephalitis. Similarly the virus is transmitted to the larva through the egg (Casals and Webster, 1944).

From what we have mentioned above we must note the severe consequence of the introduction of viruses of encephalitis and encephalomyelitis of the equine type into a specified region. Not only man, but also domestic animals and a great number of wild animals and birds may be attacked.

The virus can cause a high mortality rate among men and other animals, consequently provoking severe social, sanitary and economic disturbances.

So far we have not obtained good results with specific vaccination. As the fight against the vectors is a very difficult task, we can readily

see that the introduction of such a virus can be a very efficient weapon for the destruction of an army or a population.

B. Flies

The house fly, *Musca domestica,* also named typhoid fly, is the most common and abundant fly found in houses and in all parts of the world.

The house fly is the animal most closely associated with man. It is distributed from the subpolar regions to the tropics where it is found in very large numbers.

The fertile females are oviparous and lay almost a hundred eggs in four lots. The eggs are always deposited by the female on organic substances in the process of fermentation such as manure, garbage etc. If the eggs are deposited on non-fermentable substance, the development is much prolonged. After 12-24 hours at a temperature of 23-26° C., the first stage larva hatches from the egg. It grows rapidly and undergoes a first moult, after which will issue the second stage larva. This will develop, moult and give rise to the third stage larva, and this final stage lasts from 4-8 days. When it is completely developed, it empties its intestine and goes into a favorable substratum and takes the shape of a short thick body. The wall of the puparium is made of the third larval moult skin and within it the pupa will transform and then gives rise to the adult insect. Therefore, there are altogether four moults: 3 larval and one pupal. The pupal stage lasts from 4 to 5 days but it can be much shortened when the temperature is higher (90-95° F.), and it is longer when the temperature is lower. The complete development lasts 12 days under favorable conditions. It is subject to many variations according to the various conditions of temperature, feeding and other factors. When the conditions are favorable such as in the tropical and subtropical regions, the breeding can be continued throughout the whole year. It is estimated that the progeny of single female is around 1,875,000,000,000 after 8 generations.

In colder regions, the continued development of the fly is interrupted during winter time. Many experts have carried out experiments to find out what happens to the flies during the winter. The results are not uniform.

Thus, according to Hewitt (1914) the flies hibernate in the adult stage, but according to Hutchinson (1918) the hibernation takes place during the larval and pupal stages; according to Matheson (1950) flies hibernate during the immature stages (larva and pupa). According

to Roubaud, the insect does not hibernate but continues its reproduction during the whole winter in the warm rooms and in the stables. The flies feed on liquid substances such as milk, liquid with albumin, sputum and fecal matter and rotten fruits or other solid substances such as sugar which can be dissolved. The flies can liquefy solid substances such as sugar by means of secretions from their salivary glands, also by regurgitation and vomiting of the liquid contained in their crop. The flies have also the habit of regurgitating very frequently after their meal, leaving opaque and whitish spots (vomiting drops) which are different from the fecal spots. They can also disseminate pathogenic germs when they feed on fecal matter, sputum, or infected wounds, and then deposit the germs on foods. Flies having the body and legs covered with hairs will readily transmit germs which are stuck on them. As the fly can travel long distances of 9-18 kilometres, it can therefore disseminate germs to distant places. There is no better mechanical carrier of germs. Cox, Lewis and Glynn (1912) have shown that one single fly can carry up to 500,000 germs.

Taking into consideration that the number of germs in the intestinal tube of the fly is 816 times more than those found on its body (Torrey 1912), it is then easy to understand the great importance of the fly as carrier of pathogenic germs.

Herewith we give a list of pathogenic germs isolated from the house fly:

Salmonella typhi. Typhoid bacilli can be disseminated by the fly body and appendages as well as from its intestinal contents after vomiting or regurgitation and also from its feces. The typhoid bacilli were isolated from flies by the following workers: Hamilton (1903), Ficker (1903), Faichnie (1909), Bertarelle (1910), Graham-Smith (1909), Cochrane (1912), etc. Ficker in 1903 artificially contaminating the flies with *Salmonella typhi* showed that the bacilli can remain alive up to 23 days.

Salmonella enteritidis. Ficker (1903), Hamilton (1903), Graham-Smith (1909), Ledingham (1911), Bahr and Comb (1914) isolated *Salmonella enteritidis* from the intestinal tube of the fly. Cox, Lewis and Glynn (1912) isolated it from the external surface of the insect body. Ostrolenk and Welch (1942) have shown that the house fly artificially contaminated with *S. enteritidis* retains and disseminates the germs throughout its whole life.

Salmonella paratyphi—Isolated by Torrey (1912).

Salmonella schottmülleri:—Isolated by Nicoll (1911) from the body and intestine of the fly.

Shigella dysenteriae—Isolated by Dudgeon (1919).

Shigella paradysenteriae — Isolated by Graham-Smith (1909), Griffitts (1942), Kuhns and Anderson (1944).

Escherichia coli—Cao (1898-1906) found *Escherichia coli* on the body and in the intestine of all the flies he examined. *Escherichia coli* was also isolated from the body and intestine of *Musca domestica* by Nicoll (1911), Cox, Lewis and Glynn (1912), Torrey (1912), Scott (1917), Ostrolenk (1939-1942), etc.

Mycobacterium tuberculosis—Isolated by Spielman and Haushalter (1887) who maintained that the bacilli of tuberculosis could be disseminated by the house fly. It was also isolated by Hoffmann (1888), Celli (1888), Lord (1904), André (1908), Graham-Smith (1913), etc.

Pasteurella pestis—by Yersin (1894), Nuttall (1897).

Pasteurella tularensis—by Wayson (1914), Steinhaus (1947).

Mycobacterium leprae—by Currie (1910).

Bacillus anthracis—by Graham-Smith (1912).

Bacillus gasoformans non-liquefaciens—by Nicoll (1911).

Bacillus similcarbonchio—by Cao (1906).

Aerobacter aerogenes—by Cox, Lewis and Glynn (1912), Torrey (1912), Nicoll (1911).

Aerobacter cloacae—by Nicoll (1911).

Streptococcus agalactiae—by Saunders (1904).

Streptococcus equinus—by Torrey (1912).

Streptococcus pyogenes—by Scott (1917), Torrey (1912), Shooter and Waterworth (1944).

Streptococcus salivarius—by Torrey (1912), Cox, Lewis and Glynn (1912).

Staphylococcus spp.—Torrey (1912), Cox, Lewis and Glynn (1912).

Staphylococcus aureus—Scott (1917), Celli (1888), Cox, Lewis and Glynn (1912).

Brucella abortus—by Wishimoe (in Matheson 1947).

Vibrio comma (= cholerae) — Tizzoni and Cattani (1886), Simmonds (1909), Ledingham (1911), Nicoll (1911), Graham-Smith (1913), (1892), Maddox (1885), Macrae (1895), Hamilton (1903), Faichnie (1909), Herms (1939) and Gill and Lal (1931) even think that *V. cholerae* has a biological cycle in the body of the fly.

We shall now make a few remarks on other species of flies referred to by the Chinese scientists in their reports.

Musca vicina: Species closely related to *Musca domestica.* It was even considered only a short time ago as a different variety of *Musca domestica.* In the adult stage, it is found in the houses like the common house fly. It can transmit also the same diseases as those transmitted by the house fly.

Muscina staoulans: These are flies from the stables which also are to be found in the houses. It is a cosmopolitan species. The larvae are coprophagous and develop in animal excrements (horse, ox, etc.) and also in other fermentable materials of animal or vegetable origin. According to Patton (1931), Wollman has isolated *Brucella abortus* 24 hours after contamination of the fly. According to Steinhaus (1947), the germ *Erwinia amylovora* which is the cause of a plant disease, can live many days in the intestinal tube of the house fly and of *Muscina stabulans.* Though Bang and Glaser isolated the virus of poliomyelitis from the housefly 12 days after feeding on contaminated food, they had no success with *Muscina stabulans.* The work of Bang and Glaser was confirmed by Rendtorff and Francis (1943). The virus of poliomyelitis was isolated from the vomitus and feces of the house fly.

Lucilia sericata—The genus *Lucilia* includes a large number of species. Being little studied, the identification of the species is difficult. Thus, it is quite probable that *Lucilia sericata, L. cuprina, L. pallescens* constitute a single species. This cosmopolitan fly of warm and temperate climates has the most troublesome habit of laying its eggs indifferently on the corpses, on human wounds, animal wounds and even on the wool of sheep when the latter is soiled by the excrements or by the blood spilt during parturition. According to Brumpt (1936) the larvae nibble the skin of the sheep, producing considerable wounds causing the death of sheep amounting every year to tens of thousands in Australia (Froggat and Johnston), in New Zealand (Miller 1922), in South Africa (Smit 1928).

Lucilia sericata, was incriminated in the transmission of *Erwinia amylovora* which, according to Ark and Thomas (1936), can live for many days in the intestinal tube of this fly.

Helomyza modesta—We did not find any reference in the literature on the transmission of pathogenic germs by this fly. We must, however, point out the finding of specimens of this fly contaminated with paratyphoid bacilli.

Hylemyia sp.—Approximately 600 species are known of the genus *Hylemyia*. A few species of this genus are believed to be carriers of *Erwinia amylovora* and *E. carotovora*.

Conclusion

From what we have discussed above, we can conclude that flies are the most important agents in the dissemination of pathogenic germs. Not only can they be active biological carriers causing infections by bites (for instance *Trypanosoma gambiense* and *Trypanosoma rhodesiense* transmitted by tse-tse flies and many other examples) but also very efficient agents in the passive or mechanical dissemination of germs, either by the external surface of the body or by its regurgitation or again by the fecal matter. As the breeding and artificial contamination of these insects are very easy, they are available in great numbers and can be infected by numerous varieties of bacteria and pathogenic viruses.

It is now easy to understand why the flies should be the most convenient agents for the intensive dissemination of germs in an area or against a population.

2. Lice

Lice, exclusively blood-sucking insects, are strict parasites of man though experimental breedings can be obtained by feeding them on certain monkeys and on pigs. For this, the insects are placed in small wooden or bone cylinders closed at each end with fine silk. The cylinders are maintained in position by leather straps.

The two main types of human lice are *Pediculus humanus capitis* (head) and *Pediculus humans corporis* (body). Both are the principal carriers of epidemic typhus.

Lice can be infected at all stages of their development. During its development, the rickettsia can invade the cells of the intestinal tube of the insect. Later on, the cells will burst and free the parasites in the stools around the 8th day. Lice can transmit diseases by different methods: (1) The rickettsia found in the feces of lice penetrates through the broken skin or lesions caused by scratching. (2) It can also be introduced by lice through their mouth-parts soiled by their own excrement. (3) The rickettsia can also contaminate man when there is contact with the mucous membranes especially conjunctivae. (4) Man can also be infected by inhalation of dried particles of louse excrement.

Many experts have proved that a lot of other insects can also keep and transmit *Rickettsia prowazeki* var. *prowazeki* of the epidemic typhus. Askin and Bacot (1922) have demonstrated this phenomenon for *Pedicinus*

longiceps, the monkey louse; Dyer (1934) for *Xenopsylla cheopis,* the rat flea; Blanc and Woodward (1945) for *Pedicinus albidus.* By means of *Polyplax spinulosus,* transmission can also be effected from rat to rat. This germ has been isolated from the squirrel (*Citellus*) and was experimentally transmitted by *Dermacentor silvarium* and *Haemaphysalis concinna* (Steinhaus, 1947). The rickettsia can remain alive and virulent in the dried excrement of lice for 66 days (Starzyk 1936).

Murine typhus. This disease is caused by *Rickettsia prowazeki* var. *mooseri.* This disease is known as murine typhus because the rat is the reservoir. Clinically, murine typhus is very similar to epidemic typhus. On the whole this disease is more benign and causes fewer fatalities, but during epidemics it can be of a very severe type.

This rickettsia is transmitted by numerous species of fleas and also by the rat louse, *Polyplax spinulosus* (Mooser et al 1931). But *Rickettsia prowazeki* var. *mooseri* infects man via the rat flea, after that the body louse of man, *Pediculus humanus corporis* is able to transmit the germ among men. The following list, abridged from Hull (1947), gives the animals which can be infected with typhus.

Animals Susceptible to Typhus Fever:

Laboratory and domestic animals: Cat, dog, guinea-pig, rabbit, white rat.

Other animals: Chimpanzee, monkey (*Macacus sinicus, Macacus rhesus*), hedgehog, etc.

Rodents:

Citellus citellus
Xerus atlantoxerus getulus
Mus minutus
Microtus terrestris
Rattus rattus alexandrinus
Rattus rattus rattus
Glaucomys volans saturatus
Didelphis virginiana
Marmota monax monax
Sigmodon hispidus hispidus
Orzyomys palustris palustris
Neotoma floridana rubra
Peromyscus gossypinus gossypinus
Peromyscus nuttalli aureolus
Microtus pennsylvanicus pennsylvanicus
Peromyscus polionotus polionotus
Peromyscus leucopus noveboracensis

Trench fevers. Known also as five days fever, quintane fever, tibialgic fever, Wolhynian fevers, trench fever is caused by *Rickettsia wolhynica* and is transmitted also by lice.

According to Brumpt (1936), the part played by lice which had been suspected by different English and German authors in 1916 was experimentally established by Dawies and Weldon (1917), by Werner and Benzler (1917) and by the American Commission (Strong et al) and British Commission (Bruce et al). Trench fever is also present in Peking as found by Hoeppli and Feng (1931) who accidentally produced the disease on volunteers inoculated with grindings of the salivary glands of lice.

Other pathogenic germs transmitted by lice. Lice also transmit the cosmopolitan relapsing fever, a type of spirochaetosis not infrequently associated with typhus epidemics. As in the case of typhus, it is transmitted by crushed lice on the skin and the spirochaetes are inoculated through the lesions caused by scratching.

Head lice and body lice can also preserve plague bacilli.

Swellengrebel and Otten have succeeded 7 out of 9 times in inoculating laboratory animals with grindings of lice caught from patients. Other animal lice such as *Haematopinus columbianus, Linognathoides citelli* are potential carriers of plague bacilli. Lice of the tarbagan marmot, *Linognathus* sp., permit the prolific multiplication of plague bacilli and can bite men experimentally (Jettman 1923, in Brumpt 1936).

Pasteurella tularensis, the causative agent of a rabbit disease, is transmitted to man by many arthropods such as the rat louse *Polyplax serratus.*

Conclusion

Lice were not mentioned in the reports submited by Chinese scientists, but we think it is worthwhile to give a summary account of the part played by lice in the transmission of pathogenic germs.

As already noted, this insect is the most important vector of rickettsial diseases including epidemic typhus, its artificial breeding is easy, and it can be easily infected under laboratory conditions.

As infection of man by the rickettsia can be effected through air and as the rickettsia can survive a long time in lice reduced to powder form, we believe that in the hands of was criminals waging bacterial warfare nothing can be easier and more efficient than its dissemination in powder form.

3. Arachnida

A. Spiders. *Lycosa* sp. and *Tarentula* sp. were mentioned in the reports submitted by Chinese scientists. Spiders are divided into two groups of different origin and development: Mygalomorphae and Aranomorphae. The Aranomorphae are called true spiders with principal families: Argiopidae, Ctenidae, Lycosidae, and Flaeridiidae. The two genera mentioned by Chinese scientists *Lycosa* and *Tarentula* belong to the family Lycosidae. In the reports prepared by Chinese scientists, *Bacillus anthracis* and *Pasteurella multocida* were found on spiders. It is known that in nature spiders can be found infected with different varieties of germs. Steinhaus mentions different varieties of fungus parasites found on spiders such as: *Torrubiella aranicida, Cordyceps gonylepticida, Hirsutella arachnophila,* etc.

B. Ticks and Mites. In the Korean reports only ticks have been mentioned. They are the largest in size among the acariens. The ticks are of great medical interest because they transmit spirochaetosis and many exanthematic diseases to man especially Rocky Mountain spotted fever, macular fever of Sao Paulo, boutonneuse fever, tick bite fever etc. They can also provoke, apart from tularaemia, often fatal paralysis together with local inflammatory lesions and sometimes a generalized reaction.

They can also transmit plague from rodent to rodent or from the latter to other animals. They can equally transmit verruga and yellow fever through biting and produce murine typhus when inoculated in an emulsion form. They transmit to domestic animals piroplasmosis, theileriosis and anaplasmosis. An interesting fact was the introduction of typhus into Sao Paulo, Brazil. According to Brumpt (1936), when he discovered together with Bourroul and Guimaraes the relapsing fever epidemic of Syrian origin in Sao Paulo, their attention was drawn to the possibility of finding also the exanthematic typhus. The latter was then not seen and was non-existent in the country where it might have been confused with the tick-borne typhus. One is therefore led to ask where was the geographic origin of the disease so well studied by the physicians of Sao Paulo. Did the disease come from the United States? Or from a distant region of Brazil or from somewhere in South America? One thing is certain, said Brumpt, that is, one must eliminate the unlikely hypothesis of its importation by man infected with the disease. The latter, in fact, gets rid of fairly quickly the infecting tick which has no time to complete feeding on him, but however can infect another human being or animal.

The importation of the disease into Sao Paulo by domestic or non-domestic animals is more plausible. The identity of this infection

and the spotted fever of the United States has been demonstrated. According to Steinhaus (1947), "Unfortunately in almost every locality that the disease appeared a new name was attached to it; this was particularly true when slight variations from the original Rocky Mountain spotted fever were observed. Thus we have Eastern spotted fever, Brazilian spotted fever (Sao Paulo typhus and Minas Geraes typhus, Columbian spotted fever (Tobia fever) and Choix fever in Mexico. However, different species of ticks are commonly involved in the transmission in the different countries or sections of countries concerned." In the opinion of Brumpt: "If the identity of this infection (Sao Paulo typhus) and the spotted fever of the United States was proved, we could think of its introduction from the latter country by infected ticks living for example on dogs." We can also think of the importation into Sao Paulo of various animals, domesticated or not, from distant regions in Brazil where the disease exists among the wild animals but was not yet discovered in man. The dissemination of rickettsiae and other pathogenic micro-organisms by ticks is a fact very often mentioned. As they are vectors of serious diseases, affecting man as well as animals, it is easy to understand their great importance in this connection.

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APPENDIX C

Memorandum on the Quantitative Investigation of Bacteria Carried by Insects

One of the possible criticisms of the bacteriological data furnished by the Chinese and Korean research workers about the pathogenic micro-organisms on insects disseminated from airplanes, is that quantitative work would have been desirable in the circumstances to ascertain the approximate number of bacteria present on each insect.

At first sight this criticism seems justified for more than one reason. For example:

a) Quantitative investigations are always more satisfactory and more in accord with the general line of advance in microbiology.

b) The number of pathogenic micro-organisms per insect could constitute a proof of artificial infection, since in that case the number carried by each insect would be likely to be very large.

c) A quantitative approach would permit of sharp comparisons between the suspected insects and control material, i.e. individuals of the same species collected from places having the same hygienic conditions as those which have been subjected to the incursions of American airplanes.

Such reasoning is of course entirely plausible, but a deeper analysis reveals its abstract character and its irrelevance to the practical problems which confronted the Chinese and Korean bacteriologists.

Let us first briefly examine the main characteristics of a quantitative investigation. It can only be performed by diluting the material in question and plating out samples of known volumes on suitable media. Obviously it is necessary to know beforehand the nature of the pathogenic agent, for the media which will be suitable differ very greatly in different cases. Qualitative investigations must therefore necessarily precede quantitative ones, and this shows that the question is not so simple as it might appear at first sight.

A much more serious difficulty is that often it may not be possible to preserve the material on which the qualitative researches are being done, long enough to permit of subsequent quantitative studies. Insects coming

from one container may not be comparable (because different individuals may not carry the same pathogens), and still less so those collected at different times from different places. How then is one to find material for quantitative experiments after the qualitative test (often difficult and prolonged) has yielded a definite result?

But this is not all. Anyone who has any experience in quantitative microbiology knows how difficult it is to obtain satisfactory results in the first experiments. There are many difficulties in ascertaining the conditions adapted to the growth of all, or the great majority, of the cells present in a bacterial suspension. It is not so easy to make them form independent, visible, and accurately countable colonies. Even with classical and well-known bacteria it is difficult at first to obtain satisfactory data, and it is necessary to pay attention to many complex technical details which determine the success of this kind of research. It is superfluous to say that these technical details vary among the various bacteria, and that there are some micro-organisms with which it has always so far proved impossible to obtain satisfactory data.

Then again the working conditions during a bacteriological war must be taken into consideration. The investigator has in his hands an unknown material which has no doubt been subjected to artificial selection in the laboratories of the attacking power. He is not working in conditions sufficiently calm, nor with sufficient time at his disposal, to carry through his investigations to a satisfyingly quantitative stage. New and important material is continually coming in. One single and specific plan of quantitative work would involve many complexities and take a long time. Furthermore, by necessity, his first duty must be to find out as quickly as possible the type of pathogen disseminated in order that urgent preventive measures may be put into operation. It is patent, therefore, that any criticisms of the Chinese and Korean bacteriologists on the ground that their work has not been sufficiently quantitative, have little or no pertinence.

It may be added that when there was an opportunity for an investigation approaching a quantitative nature, as in the case of the beetle *Ptinus* infected with anthrax spores, an estimation of the number of bacteria per individual was actually carried out (see App. BB).

In general, moreover, the evidence of the dissemination of insects for war purposes was so conclusive as to render the quantitative argument quite irrelevant. The consistently negative bacteriological findings from control materials of local origin, such as flies and feathers, further lessen the significance of quantitative studies in the particular cases included in the Report.

APPENDIX D

Memorandum on the Mechanical Transmission of Bacteria by Normal Flies in China; Analysis of Studies on Random Samples

One of the first criticisms which was applied to the material concerning the suspected artificial infection of insects with pathogenic micro-organisms, supplied from Korea and China to the Western world through the Prague documentation, raised the question of the possible occurrence of pathogens in or on normal insects, especially flies. It was said that micro-organisms of the types discovered might well be expected to occur in random samples of normal flies, not only under the abnormal circumstances of the Korean theatre of war, but also under the "mediaeval and unhygienic" conditions of NE China (Manchuria) and even of Peking. The normal existence of typhoid carriers, for instance, was mentioned, and it was thought likely that in the still "primitive" state of latrines and manners in China, a certain proportion of normal flies, if examined, would be found to be infected. Hence certain pieces of work of interest carried out by Chinese bacteriologists were abstracted and included in the present Appendix.

H. Y. Yao, I. C. Yuan & Dorothy Huie, "The Relation of flies, Beverages and Well Water to Gastro-intestinal Diseases in Peking." Nat. Med. Journ. China, 1929, *15*, 410.

The authors begin by saying that it has been shown by Torrey (Journ. Inf. Dis. 1912, *10*, 166) that dysentery, typhoid and paratyphoid bacilli can be carried by flies. Their own study of the problem was made in Peking, June-Sept. 1928.

It is stated that the conditions in Peking for the contamination of flies by means of faecal matter were unusually favourable.

The flies were caught in fly traps, one being placed in each of three localities:

(a) A fruit shop without door or shutters in a very dirty and congested district where many open carts carrying human faeces passed every day.

(b) An open shop in a small dusty street, where vegetables, sugar etc. were sold.

(c) A paint shop, screened, in a rather dirty street.

The flies were collected every day. They were of the following species: *Musca domestica* (98.4%), *Fannia canicularis* and *scalaris* (1.1%), *Lucilia caesar* (0.31%), *Calliphora erythrocephala* and *vomitoria* (0.16%), *Sarcophaga carnaria* (0.03%). However, a complete entomological study of the 384,193 flies captured was not made. By far the greatest number of flies was caught during July and August, 83.2% of the flies being obtained from locality (a).

Bacteriological examinations were made once a week on flies captured the same day. A batch of 100 flies was taken at random from each of the three localities. The number of bacteria per fly internally and externally was roughly computed. The findings were:

	June	July	Aug.	Sept.
Locality (a) ext.	11,000	75,000	104,000	55,000
„ (a) int.	818,000	2,313,000	1,516,000	3,402,000
Locality (b) ext.	3,000	76,000	365,000	63,000
„ (b) int.	168,000	2,591,000	3,550,000	6,062,000
Locality (c) ext.	4,000	21,000	81,000	21,000
„ (c) int.	419,000	2,593,000	3,035,000	1,621,000

During the summer 50 batches of 100 flies each were tested for the presence of *E. coli* of faecal origin, *S. dysenteriae, S. typhosa, S. paratyphosa* and *V. cholerae*. Colon bacilli were found in the washings from the surfaces or from the internal contents of the flies in 49 out of 50 batches tested (98%). Usually (90%) they were found both externally and internally. *S. dysenteriae* were isolated from the external washings of 6 batches and from the internal contents of 12 batches during June and July. *S. dysenteriae* were found internally or externally or both in 15 out of 50 batches tested (30%).

S. typhosa, S. paratyphosa and *V. cholerae* were never encountered.

C. Y. Chow, in his paper "The Common Blue-bottle Fly, *Chrysomyia megacephala,* as a Carrier of Pathogenic Bacteria in Peking, China" (Chinese Med. Journ. 1940, *57,* 145), states as a well established fact that certain non-blood-sucking flies carry pathogenic bacteria such as those of dysentery, typhoid, cholera etc. In text-books, he says, the species *Musca domestica* is emphasised as being most important, but in fact *Chrysomyia megacephala* is the most common summer species in Peking. Expressing astonishment at the fact that Yao, Yuan & Huie failed to mention this

species in their work, he says that *Chrysomyia megacephala* seems to be an ideal fly as a carrier of faecal-borne diseases because it breeds almost entirely in liquid human faeces while the adult fly constantly visits foodstuffs, such as sweets, fruits, sliced water melons etc. This fact had already been noted by Illingworth (Proc. Hawaiian Entom. Soc. 1925, 6, 253, Patton (Chinese Med. Journ. 1926, *40*, 543 & 603), Meng & Winfield (Chinese Med. Journ. 1938, Suppl. II, 463).

In this investigation the flies were collected with a hand-net from:

(a) The open public latrines at Lung-Fu-Ssu near which there is a big market where all kinds of foodstuffs are sold.

(b) The garbage container in Tung-An market.

(c) Fruit shops in Tung-An market and the vegetable market in Tung T'an-P'ai-Lou.

Altogether 650 adult *Chrysomyia megacephala* were caught and tested from these three places, (Aug. 23rd to Sept. 28th. 1939).

Escherichia coli of faecal origin was ascertained by the indol test, V. P. test and methyl-red test. The dysentery, typhoid and para-typhoid groups of bacteria were identified by transferring the suspected colonies first on to an agar slant and then into various sugar tubes for observation of the fermentation reactions and finally by agglutination tests.

The results are given in a table as follows:

Locality	Number of flies	*E. coli*		Dysentery Group		Typhoid		Paratyphoid Group	
		Ext.	Int.	Ext.	Int.	Ext.	Int.	Ext.	Int.
(a)	250 (50 batches)	100%	100%	0	8%	0	0	0	0
(b)	250 (50 batches)	100%	82%	0	0	0	0	0	0
(c)	150 (50 batches)	80%	80%	0	0	0	0	0	0

In view of the fact that only 8% of the flies were found infected with *S. dysenteriae* the author considered the possibility that some flies might have lost their infection after they had left the latrine. He therefore made a series of experiments on laboratory-bred flies using pure cultures of *S. dysenteriae* and *S. typhosa.* The author found that bacilli of the Shiga group may remain alive on the surface of the body of the fly for at least 4 days and in the intestine of the same insect for 5 days. The mannite-fermenting group of the dysentery bacilli may remain alive on the external surface of the body as well as inside the intestine for at least 4 days. The survival period of *S. typhosa* on the external surface of the fly was 2 days while internally they may live in the intestine up to 6 days.

He concludes therefore "that the low rate of natural infection with pathogenic bacteria in our fly material was not caused by the loss of a previous infection but was probably due chiefly to the lack of material containing these organisms."

APPENDIX E

An Investigation to Determine Whether the Flies Naturally Occuring in the City of Shenyang (Mukden) Carry Intestinal Pathogenic Bacteria and *Bacillus anthracis*

(ISCC/8)

In order to find out whether the flies naturally occurring in the city of Shenyang carry pathogenic bacteria, the Department of Entomology, National Medical College, Shenyang, began on June 24th, 1952, to collect flies in various districts in the city. After entomological identifications they were sent to the Department of Bacteriology for examination. In addition, flies killed by the city inhabitants were also pooled together for examination. Those flies which had been dead for two or three days were too dry for entomological identification, and were therefore only examined for *B. anthracis*.

Section 1. Investigation on the pathogenic bacteria on the body surface and in the body of the flies

I. Procedure:

(1) Collection of flies: From June 24th to June 28th, members of the Department of Entomology went to the following districts of the city (table I) to collect flies.

Table I.

Districts / No. of lots / Species of fly	Nan-hu	Around the Ministry of Trade building	South Market	Total	
				No. of lots	No. of flies
Fannia scalaris	2		1	3	15
Muscina stabulans	3	6	26	35	175
Lucilia sericata	1	3	1	5	25
Sarcophaga sp.			13	13	65
Calliphora sp.			3	3	15
Others			3	3	15
Total	6	9	47	62	310

The flies were first identified by the Department of Entomology, and then the Department of Bacteriology took five of the same species from the same district as a lot which was killed by ether and examined in the following manner:

(2) Bacteriological Examinations:

(A) Pathogenic bacteria on the body surface. Five of the flies killed with ether were washed in 5 ml. sterile physiological saline (pH 7.2-7.4) for 15 minutes, after which they were taken out with sterile forceps and placed in a sterile test-tube. The washings were cultured as follows:

a) One ml. was added to peptone water (pH 7.8-8.0), and incubated at 37°C for 24 hours. One loopful of this culture was inoculated on a plain agar plate. The colonies were examined after the plate had been incubated at 37°C for 24 hours.

b) One ml. was added to selenite-F enrichment medium. After incubation at 37°C for 24 hours, one loopful was inoculated on Endo's medium. The colonies were examined after 24 hours incubation at 37° C.

c) Two drops of the washings were inoculated directly on a plain agar plate. The colonies were examined after 24 hours incubation at 37° C.

d) Two drops of the washings were inoculated directly on Endo's medium. The colonies were examined after 24 hours incubation at 37° C. Examinations of stained smears and pure culture were made.

e) Examination of pure culture:

i) Intestinal pathogenic bacteria: Suspicious colonies were cultured on Kligler's culture medium. After 24 hours incubation at 37° C the following examinations were carried out:

a. Colony characteristics, morphology of bacteria, Gram stain, motility, etc.

b. Biochemical characteristics: Gelatin liquefaction, urea utilization, milk coagulation, citric acid utilization, indol reaction and sugar fermentation mainly of glucose, lactose, maltose, sucrose, etc.

c. Immunological characteristics:. Agglutination tests both on slides and quantitative, against the serum of typhoid, para-typhoid A, B and C.

ii) Pure culture examination for *B. anthracis*: Colony characteristics, Gram stain, bacterial motility, growth in meat broth, hemolytic property, indol reaction; fermentation tests for glucose, maltose, sucrose, salicin, lactose, etc.; pathogenicity tests in white mouse and guinea-pig; and Ascoli test.

(B) Pathogenic bacteria inside the body: The washed flies were soaked in 5 ml. of 75% alcohol for 3 minutes, and then washed once with sterile physiological saline. The flies were then soaked in 1:2000 solution of mercuric chloride for 2 minutes, after which they were washed with sterile physiological saline for three times and finally ground in a mortar with 5 ml. of sterile physiological saline. The resulting suspension was examined in exactly the same manner as before.

II. Results: Examination of 310 flies did not reveal intestinal pathogenic bacteria (including cholera, dysentery and the Salmonella group) and *B. anthracis* either on the surface or inside the insect bodies.

Section 2. Examinations to determine whether the local specimens of the non-biting stable fly of the city of Shenyang carry any intestinal pathogenic bacteria

According to the results of examinations mentioned in the previous part, no pathogens were found in various flies. It was therefore desirable to examine whether the local specimens of the non-biting stable fly, collected by entomologists on the 12th and 13th of July from the southern part of the city of Shenyang carried any intestinal pathogens. These specimens had not been treated with disinfectants.

I. Procedure:

(1) Preparation of the flies: The non-biting stable flies were killed by ether and fifty of them as a lot were ground in a sterile mortar with 15 ml. of physiological saline into a suspension.

(2) Bacteriological examination:

i) One ml. of the suspension was inoculated into Kauffmann's medium. After incubation at 37° C for 24 hours, a loopful was transferred into Endo's medium. This was again incubated at 37° C for 24 hours before examination of the colonies.

ii) The suspension was inoculated directly on Endo's medium, and incubated at 37° C for 24 hours before examination of the colonies.

iii) Efflamination of the colonies: Same as before.

II. Results: In 400 specimens of the non-biting stable fly collected from the southern part of the city of Shenyang, no intestinal pathogenic

bacteria (including the Salmonella group and the Shigella group) were found.

Section 3. Examinations to determine whether the local forms of flies in Shenyang carry anthrax bacillus

As has been stated in the first section, it was found that from 310 flies of various species collected by the Department of Entomology (National Medical College, Shenyang), no anthrax bacillus could be isolated either from the external surface or from inside the fly bodies. So we proceeded further to make bacteriological examinations on those flies killed by inhabitants in Shenyang during the fly-abolition movement (they were collected in a period of 3 days, June 28th to 30th).

Table II.

Name of District	No. of Lots	No. of Flies
Tieh-hsi District	6	600
Pei-shih District	9	900
Shen-ho District	6	600
Ho-ping District	7	696
TOTAL	28	2796

I. 'Procedure:

The flies were divided according to their localities into lots, each composed of 100 individuals. Each group was then ground in a sterile mortar, and 20 ml. of sterile physiological saline were added to form a suspension, with which the following cultural examinations were made:

(1) On plain agar plates, the characteristics of isolated colonies were studied.

(2) The suspensions were inoculated in 1 ml. amounts into tubes of meat broth. Stained smears were made on the next day for microscopic examinations. The meat broths were further cultured on plain agar plates for isolation and study of colonies.

(3) The suspicious colonies were picked out for stained smear examinations and pure cultures, the latter being then used for examinations of motility, biochemical properties, pathogenicity and immunological reactions.

II. Results:

No anthrax bacillus was isolated from 2796 flies collected from the four districts.

Conclusions

1. The results of the first and second sections show that in an examination of 710 flies (including 575 non-biting stable flies) no bacteria of the Salmonella and Shigella groups, or cholera vibrios were isolated.

2. The results of the first and third sections show that in an examination of 3,106 flies, no anthrax bacilli were isolated.

Examined by: Chou K'un, Wu Lien-Hsi, Yang Ming-Chiu and Chao Lin.

Reported by: Hsin Chün and Ching Kuan-Hua.

August 1st, 1952.

APPENDIX F

An Investigation to Determine Whether Local Specimens of Chicken Feathers Collected from the City of Shenyang and the Town of K'uan-Tien Carry *Bacillus anthracis*

(ISCC/9)

From various districts of Shenyang (Mukden), feathers were collected in sterile test tubes and brought back for bacteriological examinations. The specimens from K'uan-Tien were collected in the same manner and sent to our laboratory for examination.

Procedures:

Two or three pieces of feathers were put directly in meat broth media. After they were incubated at 37° C for 24 hours, microscopic examinations of stained smears and isolation cultures on both plain agar and blood agar plates were then carried out. The suspicious colonies were taken out for pure culture for further examinations.

The methods adopted for pure culture examinations were stained smear examinations, morphology of colonies, motility of organism, biochemical properties, pathogenicity test to animals and immunological reactions.

	Districts	Date of Collection	No. of specimens examined
Shenyang	Shen-ho D.	July 3	5
	Ho-ping D.	July 3	2
	Tieh-hsi D.	July 3	2
	Pei-kuan D.	July 3	1
	Ta-tung D.	July 3	2
	Pei-ling D.	July 3	1
	Total		13
K'uan-tien	Nan-kuan D.	July 5	1
	First D.	July 5	2
	Total		3
TOTAL	8		16

Result and Conclusion:

From 13 local specimens collected from the city of Shenyang and 3 local specimens collected from the town of K'uan-Tien (16 specimens in all) no anthrax bacillus could be isolated.

Examined by Pai Ching-yu

Reported by Hsin Chün

Date Reported: July 14, 1952.

APP. Ga: GENERAL TABLE OF INCIDENTS IN NE CHINA AND KOREA INCLUDING SOME OF THE MORE IMPORTANT INCIDENT

Number of Case	Document	Discovered by	Localities	Intrusion of airplane: Date	Intrusion of airplane: Seen	Intrusion of airplane: Heard	Intrusion of airplane: Recorded by air observation corps	Objects Dropped: Seen	Objects Dropped: Heard	Objects Dropped: Containers Found	Objects Dropped: Results of Identification	Objects Dropped: Identified by	Possibility of direct Spraying	Disease Transmitting Agents: Date of Discovery	Living agents	Nonliving agents	Seasonal Anomalies: Temperature	Seasonal Anomalies: Number of days by which the appearance of the animals concerned antedates their normal appearance	Anomalies in the Places where the Insects, etc. were discovered	Areas covered by agents (Investigation done mostly 1-2 days after discovery)	Maximum density or quantity (approximate)	Condition of agents	Entomological Zoological or Botanical Identification	Identified by	Measures taken	Bacteriological Exa Results
1.	App. QQ I.A.D.L.*/00006 SIA/3, SIA/8(2)	Chao Kwang-Hsin Lu Chung-Ch'eng	Lao-Kwan Village, Ta-Yu District. Pen-hsi City	Feb. 29		+	+							Mar. 4	Spiders, Flies, etc,		-9.9°C	about 50	On surface of snow and ice, by the riverside	About 1 sq. Km.	20/sq. m.	Crawling on snow	*Tarentula* sp.	Wang F. C. Lu P. L.	Insects exterminated Ground disinfected with lysol & D. D. T.	*P. multocida*
2.	App. Gb (SIA/3)	Huang Teh-Kung, etc.	Race course, Fu-shun City	Feb.29 to Mar. 2			+							Mar. 4	Springtails				On stadium, On roof top	6 m. high 12 m. high			*Isotoma negishina*	Ma S. C,	Collected and exterminated	
3.	App. Gb	Li Shu-Ku, etc.	Ta-Kou Village, Li-Jen Village and Fan-Hsiao Village Fu-Shun City	Mar. 2			+							Mar. 2	Flies, Fleas, Mosquitoes, Springtails		-6.2°C	about 40	On surface of snow				*Helomyza modesta* *Pulex irritans*	Chen S. H. Lu P. L Feng L. C. Chao C. S.	Extermination of insects & disinfection	
4.	I.A.D.L./00009 SIA/8 (1)	Liu Kuang-Yi, etc.	Old-station Village Old-station District, Shen-yang City	Mar. 2			+							Mar. 3	Springtails					½ × ½ kilometers	60-70/sq. m.		*Isotoma negishina*	Ma S. C.	"	Rickettsia once found
5.	App. QQ	Wang Yu-Sheng	Chen-chiang Shan, An-tung City	Mar. 2			+							Mar. 3	Spiders		-7.0°C	about 50	On surface of snow	5000 sq. m.	About 20/sq. m.		*Tarentula* sp.	Wang F. C. Lu P. L.	"	*P. multocida*
6.	(SIA/3) App. Gb.	Tang Yu-Ying	Ta-Pien Kou Village, 7th District, Hsin-pin Hsien	Mar. 3	+	+	+							Mar. 4	Springtails					250 × 200 m.	Several hundreds per sq. m.		*Isotoma negishina*	Ma S. C.	"	
7.		Chang Kuo-Yu	Tai-ping Kou Village, 2nd District, Chi-an Hsien	Mar. 3	+	+	+							Mar. 3	Flies, mosquitoes, Fleas, spiders				On surface of snow	250 × 10 m.	>100/sq. m.				"	
8.	App. Gb.	Yu Chi-Yuan, etc.	Hung-shih-la-tze Village, 6th District Kuan-tien Hsien	Mar. 4	+	+	+							Mar. 4	Field-crickets		-7.2°C	about 80	On surface of snow by river side	2000 m.	10-20/sq. m.	Could not move about, seemed to be paralyzed by cold	*Gryllus testaceus*	Chu H. F.	"	
9.		Hsu-Cheng	Yang-mu-lin Village 3rd District, Chi-An Hsien	Mar. 4	+	+	+							Mar. 4	Flies, Mosquitoes, Springtails				On surface of snow	250 × 10 m.	>100/sq. m.				"	
10.		Tan Tien-Fa	Hsia-chien Village, Ai-ho, 7th District An-tung City	Mar. 4	+		+	During an air raid a white object like a water-melon was seen dropping from the air, which burst when it was about 60 m. above the ground.						Mar. 4	Flies, Spiders, Mosquitoes		-7.2°C		In maize field	About 30,000 sq. m.	6-7/sq. m.				"	
11.		Chu Yen-Chang Chin Yu-Fang	Ping-chung Street, Long-tou District, An-tung	Mar. 4			+							Mar. 4	Spiders, black beetles		-7.2°C		In the field and along road	About 600 sq. m.					"	
12.	App. Gb.	Li Jun-Chih Liu Po-Ching	Outside of south gate and area between South and east gates, Kuan-tien Hsien	Mar. 4			+							Mar. 4	Flies, Fleas Mosquitoes, Springtails, Ants.		-7.2°C	about 50 about 40	On surface of snow				*Muscina stabulans* *Helomyza modesta* *Pulex irritans*	Chen S. H. Lu P. L. Feng L. C. Chao C, S.	"	
13.	I.A.D.L./00008 SIA/8 (3)	Yueh Ching-Liu Yang Ching-Po	Fan-chia-tun, 5th District, Chinchow City	Mar. 4			+							Mar. 5	Flies Mosquitoes		-3°C	about 40					*Helomyza modesta* *Orthocladius* sp.	Chen S. H. Lu P. L. Liu C. L.	"	*S. paratyphosa* C and *S. typhosa*
14.	I.A.D.L./00010 ISCC/6, App. FF SIA/3 and 8(5)		Shenyang and its neighbouring district	Mar.2, Mar. 7 ...			+						?		?											
15.		Li Shih-Yung	Ssu-tao Kou Village, 2nd District of Lin-kiang Hsien	Mar. 5	+									Mar. 6	Flies Mosquitoes		-11.3°C		On surface of snow	About 60,000 sq. m.	40-50 per unit area of the size of a k'ang	Some could fly 3-4 feet high, others could not			Collected and burned	
16.	App. Gb.	Shan Wen-Jung Tu Kung-Chow	Tung-k'an-tze, 5th District, An-tung City	Mar. 6	+		+	10 minutes after the passing of an airplane objects dropped from the air like snow flakes were found to be insects when they reached the ground.						Mar. 6	Fleas, Mosquitoes, Spiders		-2°C	about 60		About 30,000 sq. m.	20-30 per sq. m.	Mostly non-mobile at the beginning, but later on some could crawl.	*Hylemyia* sp. *Orthocladius* sp.	Chen S. H. Lu P. L. Liu C. L.	"	
17.	I.A.D.L./00002 SIA/8(4) and 11	T'sao Hung-Jung, etc.	Wu-li-tan Bridge, Kou-chia-tze, station, Shenyang City	Mar. 7			+							Mar. 7	Flies,		1.1°C	about 60	Along railway; on and under the bridge			Flying	*Hylemyia* sp.	Chen S. H. Lu P. L.	Extermination	
18.		Wu Ching-Fu, etc.	Lung-wang Miao 7th District, An-tung	Mar. 10		+	+							Mar. 11		Feathers			On roof tops, trees and haystacks			White in color like duck feathers			Collected and burned	
19.	I.A.D.L./00005 ISCC/5, App. AA, SIA/8(6), SIA/6	Chiang Wen-Ch'ang, etc.	Pei-ching Village, 5th Districts, An-tung	Mar. 11	+		+	A greyish white object was dropped by airplane flying over the village. The object fell to the southeast of the village it exploded and disappeared shortly before reaching ground						Mar. 11		Feathers			Luan-shih Hill, southeast of the village			White and downy very clean			"	
20.	(SIA/3)	Kao Chung-Yun, etc.	Tien-yi Village, 5th District, Chuang-ho Hsien	Mar. 12		+	+							Mar. 13	Mosquitoes					About 1500 sq. m.	> 100 per sq. m.	Some could fly, others could not			Collected and exterminated	
21.	I.A.D.L./00001 ISCC/.3, App V, SIA/3, 8(2), 12	Han Yung-Pin Li Ssu-Chien	Outside of east gate Kuan-tien	Mar. 12	+		+	White cylindrical object seen dropping from an airplane; it fell slowly at first but rapidly later		+	Calcareous fragments steel cap-shaped plate and iron axis.	Chao, C. Y., Ho, T. H., Chang, Y. C.		Mar. 13-22	Flies Spiders	Feathers		about 50 about 40	Snow ground near point of impact			White and yellow downy, clean and complete. No skeleton nearby	*Hylemyia* sp. *Tarentula* sp.	Chen S. H. Lu P. L. WangF. C.	Collected and exterminated Collected and burned	*B. anthracis* *B. anthracis* *B. anthracis*
22.	(SIA/3)	Yu Chung-Lin Kuo Lien-Sun	Shan-ya Kou, Ku-shan, Antung	Mar. 13		+	+							Mar. 13	Flies Mosquitoes		2.2°C		On surface of snow	1000 × 250 m.	60 per sq. m.				Collected and burned	
23.	I.A.D.L./00004, App. AA, SIA/3 and 8(9)	Wang Yu-Tsai, etc.	San-ho Village, Ssu-ping City	Mar. 14			+							Mar. 17	Flies		-1.8°C	about 50	On sand heaps	20 sq. m.	Total 7000	Abdomen full, could crawl but not fly	*Musca vicina*	Chin Y. T. Feng L. P.	Collected and burned	*B. anthracis*
24.	I.A.D.L./000007 SIA/3, 8(8) and 12	Sun Chia-Hsun, etc.	Dormitory of Ministry of Trade, Yang-wu Street, Shenyang	Mar. 15			+	Bright object dropping from the air						Mar. 15	Flies Locusts, Mosquitoes		4.0°C	about 40 about 50 about 90 about 30 about 60	Cement tennis court; open platform, 2nd floor				*Muscina stabulans* *Lucilia sericata* *Locusta migratoria* *Acrydium* sp. *Culex pipiens* var. *pallens*	Chen S. H. Lu P. L. Feng L. C. Chao C. S. Chen S. H. Lu P. L. Chin Y. T. Chin Y. T.	Extermination by burning Disinfection	*S. typhosa*
25.		Li Tien-Hui	Yung-an Village, 12th District, Ke-shan Hsien	Mar. 17	+		+	Two white packets were seen falling after the passing of an airplane.						Mar. 17	Fleas, lice	Cotton balls	-4.4°C		On waste-land						Collected and burned	
26.	App. Ja	Fu-ming	Sun-chia-pao-tze, Wu-lung Pei, An-tung	Mar. 17			+							Mar. 18		Corn grains						Blackish spots on grains			Collected and burned	*Thecaphora* sp.
27.		Wang Yu-Ping, etc.	Laha Town, Na-ho Hsien	Mar. 19			+							Mar. 20	Flies, Mosquitoes, Spiders				On surface of snow and ice in a river	About 900 sq. m.	10 + per sq. m.	Some frozen to death			"	

E OF THE MORE IMPORTANT INCIDENTS MENTIONED IN THE PRAGUE DOCUMENTS

Entomological Zoological or Botanical Identification	Identified by	Measures taken	Bacteriological Examination: Results	Bacteriological Examination: Examined by	Consequences: Victims	Locality of victims	Date of onset of disease	Abnormality of Infection	Anamaly in season	Anomaly in locality	Anomaly in type	Clinical Diagnosis	Diaynosed by	Pathological Diagnosis	Diagnosed by	Bacteriological Examinations (Post-mortem)	Examined by	Preventive measures	Remarks
Tarentula sp.	Wang F. C. Lu P. L.	Insects exterminated Ground disinfected with lysol & D. D. T.	*P. multocida*	Ching K. H. Chu C. M.															
Isotoma negishina	Ma S. C,	Collected and exterminated																	
Helomyza modesta *Pulex irritans*	Chen S. H. Lu P. L Feng L. C. Chao C. S.	Extermination of insects & disinfection																	
Isotoma negishina	Ma S. C.	„	Rickettsia once found	Chu C. M.															Rickettsia bodies disappeared on sub-culturing
Tarentula sp.	Wang F. C. Lu P. L.	„	*P. multocida*	Sun, C. C.	Ducks	Hsing-lung street Antung city	March 8	+						Fowl Septicemia	Sun C. C.	*P. multocida*	Chao C. L. Chu C. M.	Collection and extermination of spiders	Ducks were looking for food at the place where spiders were found
Isotoma negishina	Ma S. C.	„																	
		„																	
Gryllus testaceus	Chu H. F.	„																	An-tung temperature
		„																	
		„																	
		„																	
luscina stabulans *Helomyza modesta* *Pulex irritans*	Chen S. H. Lu P. L. Feng L. C. Chao C, S.	„																	An-tung temperature
Helomyza modesta *Orthocladius* sp.	Chen S. H. Lu P. L. Liu C. L.	„	*S. paratyphosa C* and *S. typhosa*	Ching K.H. Chu C. M.															
					Human	Shenyang and its neighbour hood	March	+	+		+	Acute encephalitis	Kuo A. J. Chang H.T. Wu C. C.	Acute encephalitis (a few cases with peculiar pneumonia)	Li P. L. Hu C. H. Lin C.K. Wu T. T. & HsuY.K.	No virus isolated; *Diplococcus pneumoniae* found in a few cases	Chu C.M. Hsin C.	Cremation of the dead isolation of the sick extermination of insects and mosquitoes & improvement of sanitation	
		Collected and burned																	
Hylemyia sp. *Orthocladius* sp.	Chen S. H. Lu P. L. Liu C. L.	„																	
Hylemyia sp.	Chen S. H. Lu P. L.	Extermination																	
		Collected and burned																	
		„		Ching K. H. Hsin C. Chao C. L.	Human	Eastern Shuang-shan village 5th District An-tung	April 16	+		+	+			Haemorrhagic anthrax meningitis Respiratory anthrax infection	Li P. L. Wu T. T.	*B. anthracis*	Hsin C. & Cheng K.	Cremation of the dead disinfection of houses improvement of sanitation and inoculation of animals	East Shuang-shan village is about 1½ kilometer away from Pei-ching village and the land of the dead man is about 1 Km. from Pei-ching village
		Collected and exterminated																	
Hylemyia sp. *Tarentula* sp.	Chen S. H. Lu P. L. WangF. C.	Collected and exterminated Collected and burned	*B. anthracis* *B. anthracis* *B. anthracis*	Hsin chin Zia S. W.															
		Collected and burned																	
Musca vicina	Chin Y. T. Feng L. P.	Collected and burned	*B. anthracis*	Hsin C. Cheng K.	Human	Man-ching Station south to Ssuping	March 19	+		+	+			Respiratory anthrax	Li P. L. Wu T. T.	*B. anthracis*	Hsin C. Cheng K.	„	Flies were also discovered north to Man-ching station at the same time
Muscina stabulans *Lucilia sericata* *Locusta migratoria* *Acrydium* sp. *Culex pipiens* var. *pallens*	Chen S. H. Lu P. L. Feng L. C. Chao C. S. Chen S. H. Lu P. L. Chin Y. T. Chin Y. T.	Extermination by burning Disinfection	*S. typhosa*	Ching K. H. Chu C. H.															-10°C in the night when insects were discovered
		Collected and burned																	
		Collected and burned	*Thecaphora* sp.	Tai F. L. Chow C. C. Shen C. Y. Ch'iu W. F.															
		„																	

INCIDENTS IN

																Feathers			trees and haystacks			white in color like duck feathers			Collected and burned		
19.	I.A.D.L./00005 ISCC/8, App. AA, SIA/8(6), SIA/6	Chiang Wen-Ch'ang, etc.	Pei-ching Village, 8th Districts, An-tung	Mar. 11	+		+	A greyish white object was dropped by airplane flying over the village. The object fell to the southeast of the village it exploded and disappeared shortly before reaching ground						Mar. 11		Feathers			Luan-shih Hill, southeast of the village			White and downy very clean			"		C H C
20.	(SIA/8)	Kao Chung-Yun, etc.	Tien-yi Village, 5th District, Chung-ho Hsien	Mar. 12		+	+							Mar. 13	Mosquitoes					About 1500 sq. m.	> 100 per sq. m.	Some could fly, others could not			Collected and exterminated		
21.	I.A.D.L./00001 ISCC/3, App V, SIA/3, 8(2), 12	Han Yung-Pin Li Ssu-Chien	Outside of east gate Kuan-tien	Mar. 12	+		+	White cylindrical object seen dropping from an airplane; it fell slowly at first but rapidly later		+	Calcareous fragments steel cap-shaped plate and iron axis.	Chao, C. Y., Ho, T. H., Chang, Y. C.		Mar. 13-22	Flies Spiders	Feathers		about 50 about 40	Snow ground near point of impact			White and yellow downy, clean and complete. No skeleton nearby	*Hylemyia* sp. *Tarentula* sp.	Chen S. H. Lu P. L. WangF. C.	Collected and exterminated Collected and burned	*B. anthracis* *B. anthracis* *B. anthracis*	H Z
22.	(SIA/8)	Yu Chung-Lin Kuo Lien-Sun	Shan-ya Kou, Ku-shan, Antung	Mar. 13		+	+							Mar. 13	Flies Mosquitoes		2.2°C		On surface of snow	1000 × 250 m.	60 per sq. m.				Collected and burned		
23.	I.A.D.L./00004, App. AA, SIA/3 and 8(9)	Wang Yu-Tsai, etc.	San-ho Village, Ssu-ping City	Mar. 14			+							Mar. 17	Flies		-1.8°C	about 50	On sand heaps	20 sq. m.	Total 7000	Abdomen full, could crawl but not fly	*Musca vicina*	Chin Y. T. Feng L. P.	Collected and burned	*B. anthracis*	B C
24.	I.A.D.L./000007 SIA/3, 8(8) and 12	Sun Chia-Hsun, etc.	Dormitory of Ministry of Trade, Yang-wu Street, Shenyang	Mar. 15			+	Bright object dropping from the air						Mar. 15	Flies Locusts, Mosquitoes		4.0°C	about 40 about 50 about 90 about 30 about 60	Cement tennis court; open platform, 2nd floor				*Muscina stabulans* *Lucilia sericata* *Locusta migratoria* *Acrydium* sp. *Culex pipiens* var. *pallens*	Chen S. H. Lu P. L. Feng L. C. Chao C. S. Chen S. H. Lu P. L. Chin Y. T. Chin Y. T.	Extermination by burning Disinfection	*S. typhosa*	Ch C
25.		Li Tien-Hui	Yung-an Village, 12th District, Ke-shan Hsien	Mar. 17	+		+	Two white packets were seen falling after the passing of an airplane.						Mar. 17	Fleas, lice	Cotton balls	-4.4°C		On waste-land						Collected and burned		
26.	App. Ja	Fu-ming	Sun-chia-pao-tzu, Wu-tung Pei, An-tung	Mar. 17			+							Mar. 18		Corn grains						Blackish spots on grains			Collected and burned	*Thecaphora* sp.	Ta Ch Sh Ch
27.		Wang Yu-Ping, etc.	Laha Town, Na-ho Hsien	Mar. 19			+							Mar. 20	Flies, Mosquitoes, Spiders				On surface of snow and ice in a river	About 900 sq. m.	10 + per sq. m.	Some frozen to death			"		
28.		Tung Lin-Shan	Railway Station Ke-shan Hsien	Mar. 19	+		+							Mar. 20	Flies, Spiders		-11.2°C		On surface of snow	1000×30 m.		Some living and some dead			"		
29.		Huang Hsiu-Lan, etc,	First District, An-tung City	Mar. 20	+		+	Three white objects seen dropping down from a height of about 3000 m. when they were about 100 m. above ground they suddenly burst with spreading of leaves, feathers, etc.						Mar. 20		Leaves Feathers			Roof tops and court yard of a department store, and its vicinity	About 2,0000 sq. m.	3-4/sq. m.	With blackish yellow spots and small holes			"		
30.	I.A.D.L./00003 SIA/8(10)	Wu Feng-Chih	In front of Tieh-ling Station	Mar. 15			+							Mar. 19	Mosquitoes			about 60					*Aëdes koreicus*	Chin Y. T. Chang T. P.	Collected and exterminated		
31.	App. AA.	Jen Wan-Ku, etc.	Pei-chiao-chang Village, Liu-erh-pu District, Liao-yang. Liu-erh-pu Town, Liao-yang. An-shan City.	Mar. 20 Mar. 27		+	+ +	A red object simulating a thermos flask was seen to drop through the air. Burst when about 3-4 m. above the roof of the houses, with an explosive puff and a disagreeable smell. +						Mar. 20 to Mar. 28	Small reddish insects				Outside of houses and in the field	Total area 30 × 20 km.			*Ptinus fur.*	Liu C. L. Lu P. L.	Collected and burned	*B. anthracis*	Zia Chan
32.	App. AA.		North District, Shenyang City																								
33.	App. QQ.	Yang Kuang-Hsiu, etc.	Nu-erh River, Chin-chow City											Mar. 21	Spiders, Mosquitoes, flies.				Floating down from upper Nu-erh river						Collected from water and exterminated		
34.		Hu Shu-Fang, etc.	Ming-chu Road, Shan-fu Road and Lao-tung Lake, Chichihar City	Mar. 25			+							Mar. 26 Mar. 31	Flies, Mosquitoes, small black insects Flies, Mosquitoes				On ice						Collected and burned		
35.	App. Y.	Li Ming-Cheng, etc.	Chia-tsai-shui Village, Ch'ang Pai Hsien	Mar. 26		+	+		+	+	Four-compartment bomb.			Mar. 27 to Apr. 1	Flies, Mosquitoes, Fleas Sprintails, Spiders, Crickets			about 60	On surface of snow near the containers				*Orthocladius* sp. *Gryllus testaceus*	Liu C. L. Chu H. F.	"		
36.	App. M	Chen Wan-Fu, etc.	10th District, Kan-Nan Hsien	Apr. 4		+	+							Apr. 5	Voles				On roof tops, in court yards, in ponds, in vegetable cellars, etc.	15 × 5 kilometers	Total 717 voles	Mostly dead; living ones were ill and moved with difficulty	*Microtus* sp.	Hsia W. P. Chi S. L.	Burning & burying of voles; inoculation of inhabitants, disinfection of houses by flaming; killing of fleas, rats, cats and dogs; improving sanitation.	*P. pestis*	Tsui Chi
37.	App. Jb	Ma Hsiu-Lin	Sheng-ch'an Village, Hsiu-Yen Hsien	July 10	+			Large amount of leaves dropping through the air.						July 10		Leaves			In the fields	10,000 sq. m.	1 leaf per 3 sq. m.	Brown in color with diseased spots	*Prunus persica*	Liu S, K. Lin Y and K'ang Y. J.	Collected and burned	*Macrophoma Kuwatsukai*	Shen e

INCIDENTS IN KOREA

1.	SIA/1		Pengan (Pyong-kang), Kanvon (Kangwon Do)	Jan. 28	+										Flies Fleas Spiders and Mites								*Hylemyia* sp. *Pulex irritans* *Trombicula akamushi*			*V. cholerae*	
2.	SIA/1		Chulwon, Kanvon (Kangwon Do)	Feb. 11	+			+		+					Flies Fleas								*Hylemyia* sp. *Pulex irritans*			*P. pestis*	Kim F
3.	SIA/1,SIA/4		Anju, Pyong-An-Nam Do	Mar. 18	+										Fleas								*Pulex irritans*			*P. pestis*	
4.	SIA/1		Dedon, (Daidong) Pyong-An-Nam Do	Feb. 26	+										Flies								*Hylemyia* sp.			*V. cholerae*	
5.	SIA/1		Kandon, Pyong-An Nam	Feb. 27	+										"								"			*S. typhosa* and *S. paratyphosa*	
6.	SIA/1		Sonchon, Pyong-An-Nam Do	Feb. 27	+										"								"			*S. typhosa* and *S. dysenteriae*	
7.	SIA/1		Chulsan, Pyong-yang Do	Mar. 1	+										Fleas								*Pulex irritans*			*P. pestis*	
8.	SIA/1		Kovon (Kowon), Kangon (Hamkyong Do)	Mar. 2	+										"								"			"	
9.	SIA/1		Pyong-yang City	Mar. 4											Flies								*Hylemyia* sp.			*V. cholerae*	
10.	ISCK/2 App. R		Kang-sou, Pyong-An-Nam Do	Mar. 25		+									Fleas				On surface of water				*Pulex irritans*			*P. pestis*	Ri Yu Chen kue
11.	ISCK/3 App. T		Hoi-yang	Apr. 23		+									Fleas				Hill side	10×30 m.	many thousands		"			*P. pestis*	Chen Ku
12.	ISCK/1 App. CC		Dai-dong	May. 16		+				+					Clams				Hill side				*Meretrix meretrix*			*V. cholerae*	Kin Ra Wei
13.	App. X		Yalu River	Jun. 6	+			+							Two kinds of insects												

* I.A.D.L. = International Association of Democratic Lawyers (four-zero series).

				Chao C. L.		...an village 5th District An-tung	16							Respiratory anthrax infection				Improvement of sanitation and inoculation of animals	Pei-ching village and the land of the dead man is about 1 Km. from Pei-ching village
		Collected and exterminated																	
Hylemyia sp. *Tarentula* sp.	Chen S. H. Lu P. L. WangF. C.	Collected and exterminated Collected and burned	*B. anthracis* *B. anthracis* *B. anthracis*	Hsin chin Zia S. W.															
		Collected and burned																	
Musca vicina	Chin Y. T. Feng L. P.	Collected and burned	*B. anthracis*	Hsin C. Cheng K.	Human	Man-ching Station south to Ssuping	March 19	+		+	+			Respiratory anthrax	Li P. L. Wu T. T.	*B. anthracis*	Hsin C. Cheng K.	"	Flies were also discovered north to Man-ching station at the same time
Muscina stabulans *Lucilia sericata* *Locusta migratoria* *Acrydium* sp. *Culex pipiens* var. *pallens*	Chen S. H. Lu P. L. Feng L. C. Chao C. S. Chen S. H. Lu P. L. Chin Y. T. Chin Y. T.	Extermination by burning Disinfection	*S. typhosa*	Ching K. H. Chu C. H.															-10°C in the night when insects were discovered
		Collected and burned																	
		Collected and burned	*Thecaphora* sp.	Tai F. L. Chow C. C. Shen C. Y. Ch'iu W. F.															
		"																	
		"																	
		"																	
Aëdes koreicus	Chin Y. T. Chang T. P.	Collected and exterminated																	
Ptinus fur.	Liu C. L. Lu P. L.	Collected and burned	*B. anthracis*	Zia S. W. Chang N. C.	Human	Liu-erh-pu Town Liaoyang Anshan city	April 6			+	+			Respiratory anthrax	Li P. L.	*B. anthracis*	Liu S. M.	"	
					Human		April 11			+	+			Haemorrhagic anthrax meningitis	Wu T. T.		Chu C.M.	"	
					Hunan	Shenyang city	March 20		+	+	+			"	"	"	"	"	From beginning of March American airplanes intruded and disseminated insects over Shenyang repeatedly.
		Collected from water and exterminated			Ducks	Animal Breeding Station, Chingchow	March 22	+						Fowl Septicemia		*P. multocida*	Chao C.L. Chu C.M.	Serum Treatment Extermination of insects	Air alarm in the upper valley of Nü-erh River.
		Collected and burned																	
Orthocladius sp. *Gryllus testaceus*	Liu C. L. Chu H. F.	"																	
Microtus sp.	Hsia W. P. Chi S. L.	Burning & burying of voles; inoculation of inhabitants, disinfection of houses by flaming; killing of fleas, rats, cats and dogs; improving sanitation.	*P. pestis*	Tsui C. S. Chi S. L.															
Prunus persica	Liu S. K. Lin Y and K'ang Y. J.	Collected and burned	*Macrophoma Kuwatsukai*	Shen C. Y. etc															
Hylemyia sp. *Pulex irritans* *Trombicula akamushi*			*V. cholerae*																
Hylemyia sp. *Pulex irritans*			*P. pestis*	Kim Oun-En															
Pulex irritans			*P. pestis*		Human	Bal-Nam-Ri	Feb. 25	+	+	+		Plague							53 ill, 36 deaths (population 600)
Hylemyia sp.			*V. cholerae*																
"			*S. typhosa* and *S. paratyphosa*																
"			*S. typhosa* and *S. dysenteriae*																
Pulex irritans			*P. pestis*																
"			"																
Hylemyia sp.			*V. cholerae*																
Pulex irritans			*P. pestis*	Ri Yu-Kyu Chen Wen-kuei	Human	Kang-Sou goon		+	+	+									1 death
"			*P. pestis*	Chen Wen Kuei															
Meretrix meretrix			*V. cholerae*	Kin Rak-ze Wei Hsi		Dai-Dong		+	+										2 deaths

TESTIMONIES OF FOUR CAPTURED AMERICAN AIRMEN

TRAINING RECEIVED REGARDING BACTERIOLOGICAL WARFARE

Case No.	Name of War Prisoner	Date of Capture	CONTENTS OF LACTURES: Time	Place	Lecturer	Bacteria-Containers and Methods of Dissemination	Disease Transmitting Agents: Living Agents	Non-living Agents	Bacteria and other Pathogens	Misce
1	Lt. K. L. Enoch	Jan. 13, 1952	Aug. 25, 1951	Iwakuni, Japan	Mr. Wilson	(1) By dropping a bomb full of dust and bacteria mixed together, which will open in the air so that the wind will spread the germ-laden dust; (2) by dropping dust directly from the airplane itself, by means of a spraying device, so that there will be germs in the air wherever the dust is sprayed; (3) by dropping a paper or cardboard box full of germ dust into water, which will open up after being thoroughly wetted; (4) by dropping a germ bomb which looks just like an ordinary bomb, but is filled with germ-laden insects, and which will open on contact with the ground to release them; (5) by dropping insects in paper or cardboard containers which will break open on contact with the ground, releasing the insects with their germs; (6) by dropping parachute containers which will release small animals inside upon contact with ground, or by releasing such animals from a boat behind the enemy shore line; (7) by artillery shells. In order to avoid harm to the insects, the bombs should be dropped from as low an altitude and at as low an airspeed as possible. If parachute-type weapons are used any altitude will suffice, but it should be sufficiently low for example 1000 feet.	Lice, fleas, flies, mosquitoes, rodents, rabbits and other small animals.	Leaflets, toilet paper, envelopes and other paper materials which have been covered with germs; germ-filled soaps or clothing; fountain-pens filled with germ-laden ink and food contaminated with bacteria.	Typhus, typhoid, cholera, dysentery, smallpox, malaria, yellow fever and plague.	
			Oct. & Dec. 1951	Kunsan, Korea	Major Browning					Pilots and other receive protective in
2	Lt. J. Quinn	Jan. 13, 1952	Dec. 18, 1951	"	Mr. Ashfork	(1) The germs could be spread by dust, just as a smoke screen is laid down or spread by ships moving in close to shore when the wind is blowing on to the shore or by low-flying jet aircraft; (2) by dropping boxes that will become very fragile in the sun, allowing germ-laden insects to crawl out; (3) by dropping bombs which look very much like regular 500 pounders which will split into two halves on touching the ground to release insects; (4) by dropping bombs which will open small doors in the air, thus letting the wind blow out the insect-carrying boxes inside; (5) by dropping insect-carrying clothes.	Lice, fleas, flies, mosquitoes, rodents.		Typhus, typhoid, plague, yellow fever, cholera, malaria and encephalitis.	Inoculations shoul germ-laden insects an bred for many genera ditions and are able t time, even in the They can withstand for a very long time
3	Lt. P. R. Kniss	Mar. 31, 1952	June 1951	Craig Air Force Base, U.S.A.	Capt. Laurie					Expected to see nel attending special being provided with special inoculations
			Feb. 22, 1952	Camp Stoneman, U.S.A.	Capt. Holleman	(1) Direct spraying from airplanes. (2) Germ bombs with variable time-fuses (V. T. bomb). (3) Containers attached to parachutes (carrying animal or insect vectors). (4) Direct contamination of water-supply in the rear of enemy territory by intelligence agents.				
			Mar. 21, 1952	K-46 Korea	Capt. McLaughlin	(1) Direct spraying from airplanes. (2) V.T. germ bombs. (3). Animal parachute bombs. The V. T. germ bomb will be dropped during a dive from 10,000 feet to 6,000 feet. The bomb will explode about 100 feet above the ground and spread the germs for around 100 yds. This bomb will be dropped close to a city but not in it, because the North Korean people have used disinfectants widely in their cities and these would kill the germs. The animal parachute type will be dropped during a dive from 10,000 feet to 1,000 feet. The parachute will lower the bomb gently to earth. When the bomb strikes the ground, it will break into two parts to let the animals and insects escape. This also will be dropped near a large city, but not in it, where the people could kill the animals or insects as they escape. With both types of bombs, the flight must not be over 12,000 feet or else the animals, insects or germs will be killed due to lack of oxygen and the extreme cold.	Lice, fleas, rodents.		In V. T. bombs, three types of diseases will be disseminated; namely typhoid fever, malaria, and bubonic plague.	The eighteenth been waging germ wa Aircraft will be sent germ spraying. The used in Korea and germ bomb will be take-off by special c sterilized after return pilot will take a sho briefing and the follo a blood test to see material in the lec secret." U.S. govern germ warfare as lo
4	Lt. F. B. O'Neal	Mar. 4, 1952	Dec. 1, 1952	Luke Base Phoenix, Ariz. U.S.A.	Major Williams	Bacteriological warfare could be waged in two ways: (1) by the ground forces using bacteriological artillery shells and (2) by the Air Forces dropping germ bombs which contain either bacteria or bacteria infected insects. Artillery shells carry less bacteria and their range of dispersion is limited to the front lines or relatively close to them. Bombs carry more bacteria and can be dropped far behind the front lines and deep into enemy territory.	Rodents and other animals, mosquitoes, flies, lice, fleas, bed-bugs, spiders, etc.		Malaria, dysentery, yellow fever, typhoid, plague, typhus, and cholera.	Special cold-wi had been develope
			Jan. 22, 1952	Advanced Base in Korea	Capt. McLaughlin	(1) Air-burst V. T. germ bombs. The bombs have to be dropped from at least 5,000 feet and they will explode about 50-100 feet above the ground. They have the same external appearance as regular 500 lbs. bombs. (2) Parachute insect-bombs. The bombs will split into two halves or the small doors on the bomb will open to release insects on touching ground. (3) Direct spraying. Bacterial suspensions or bacteria-infected insects are sprayed from the rear end of the aircraft.	Bacteria Flies, mosquitoes, spiders, etc.	Bacteria carrying leaflets and papers.	Typhus, typhoid, cholera, dysentery and bubonic plague.	America has w There are fou are provided with event of engine tr get, if they are s friendly territory, unarmed in an record the exact l the bomb line, th armed and the lo case of spraying a trouble, the pilot w ly airfield or to ba and burn.

TRAINING RECEIVED REGARDING BACTERIOLOGICAL WARFARE					BACTERIAL BOMBS DROPPED			
CONTENTS OF LACTURES								
and Methods of Dissemination	Disease Transmitting Agents: Living Agents	Disease Transmitting Agents: Non-living Agents	Bacteria and other Pathogens	Miscellaneous	Time	Place	No. of Bombs	External Appearance of Bomb
and bacteria mixed together, which will open in the aden dust; (2) by dropping dust directly from the ice, so that there will be germs in the air wherever r cardboard box full of germ dust into water, which (4) by dropping a germ bomb which looks just like aden insects, and which will open on contact with the ects in paper or cardboard containers which will break e insects with their germs; (6) by dropping parachute inside upon contact with ground, or by releasing such line; (7) by artillery shells. the bombs should be dropped from as low an altitude achute-type weapons are used any altitude will suffice, 1000 feet.	Lice, fleas, flies, mosquitoes, rodents, rabbits and other small animals.	Leaflets, toilet paper, envelopes and other paper materials which have been covered with germs; germ-filled soaps or clothing; fountain-pens filled with germ-laden ink and food contaminated with bacteria.	Typhus, typhoid, cholera, dysentery, smallpox, malaria, yellow fever and plague.		Jan. 7, 1952 Jan. 11, 1952	Hwangju, Korea Chunghwa, Korea	2 4	Looks exactly like a regular 500 lbs. bomb except no time fuse. "
				Pilots and other personnel should constantly receive protective inoculations.				
st, just as a smoke screen is laid down or spread by nd is blowing on to the shore or by low-flying jet airme very fragile in the sun, allowing germ-laden inwhich look very much like regular 500 pounders which ground to release insects; (4) by dropping bombs which etting the wind blow out the insect-carrying boxes hes.	Lice, fleas, flies, mosquitoes, rodents.		Typhus, typhoid, plague, yellow fever, cholera, malaria and encephalitis.	Inoculations should be kept up to date. The germ-laden insects and small animals have been bred for many generations under laboratory conditions and are able to survive anywhere at anytime, even in the most adverse environment. They can withstand cold weather and can live for a very long time without food.	Jan. 4, 1952 Jan. 11, 1952	South of Pyongyang, Korea 3 miles north of Kunuri, Korea	4 2	" "
				Expected to see in 1952 all military personnel attending special courses in germ warfare, being provided with protective masks and given special inoculations against germs.	March 27, 1952	South of Soriwon, Korea	8	Two exploded "on the ground and gave rise to a grey cloud of smoke rising to a height of 100 feet. Six exploded in the air and formed a grey cloud about 100 feet in diameter which disappeared in about 45 seconds.
(2) Germ bombs with variable time-fuses (V. T. bomb). ying animal or insect vectors). (4) Direct contamination territory by intelligence agents.								
(2) V.T. germ bombs. (3). Animal parachute bombs. ed during a dive from 10,000 feet to 6,000 feet. The bomb nd and spread the germs for around 100 yds. This bomb it, because the North Korean people have used disinfec d kill the germs. dropped during a dive from 10,000 feet to 1,000 feet. The earth. When the bomb strikes the ground, it will break ects escape. This also will be dropped near a large city, the animals or insects as they escape. t must not be over 12,000 feet or else the animals, insects gen and the extreme cold.	Lice, fleas, rodents.		In V. T. bombs, three types of diseases will be disseminated; namely typhoid fever, malaria, and bubonic plague.	The eighteenth Fighter Bomber Group has been waging germ warfare since January 1, 1952. Aircraft will be sent to Japan to be equipped for germ spraying. The spraying method has been used in Korea and has been successful. The germ bomb will be loaded 15 minutes before take-off by special crews. The aircraft will be sterilized after returning from the mission. The pilot will take a shower immediately after debriefing and the following day they will be given a blood test to see if they are all right. The material in the lecture is considered as "top secret." U.S. government will deny the facts of germ warfare as long as possible.				
					The germ bomb missions he knew about are as follows:			
					April 5, 1952 April 15, 1952 May 5, 1952 May 21, 1952	5 miles south of Siranju, Korea 5 miles east of Sanchon, Korea Near Pyongyang, Korea 5 miles east of Kunari, Korea	8 2 2 8	V. T. germ bombs Parachute bombs " V. T. germ bombs
d in two ways: (1) by the ground forces using bacteriolo orces dropping germ bombs which contain either bacteria ells carry less bacteria and their range of dispersion is se to them. Bombs carry more bacteria and can be drop into enemy territory.	Rodents and other animals, mosquitoes, flies, lice, fleas, bed-bugs, spiders, etc.		Malaria, dysentery, yellow fever, typhoid, plague, typhus, and cholera.	Special cold-withstanding bacteria and insects had been developed in laboratories.				
The bombs have to be dropped from at least 5,000 feet and ve the ground. They have the same external appearance bombs will split into two halves or the small doors on the ching ground. spensions or bacteria-infected insects are sprayed from the	Bacteria Flies, mosquitoes, spiders, etc.	Bacteria carrying leaflets and papers.	Typhus, typhoid, cholera, dysentery and bubonic plague.	America has waged bacteriological warfare. There are four planes in his group, which are provided with spraying apparatus. In the event of engine trouble on the way to the target, if they are south of the bomb line or in friendly territory, the bombs should be dropped unarmed in an uninhabited area but should record the exact location. If they are north of the bomb line, the bombs should be dropped armed and the location should be reported. In case of spraying aircraft, in the event of engine trouble, the pilot was to land at the closest friendly airfield or to bail out and let the aircraft crash and burn.	Feb. 15, 1952	West of Sibyon-ni, Korea	8	V. T. germ bombs

APPENDIX Gb

Entomological Data on the Insects Disseminated by U.S. Military Planes

(ISCC/10)

The present paper deals with the data on insects disseminated by American planes in Northeast China and Tsingtao. It consists of two parts: (1) general considerations and (2) considerations by species. The specimens of insects and spiders mentioned in the present paper are kept either in Peking or Shenyang.

CONTENTS

I. GENERAL CONSIDERATIONS

A. *Evidence showing the dissemination of insects by American airplanes.*

Since February 29th, 1952, these planes have continually disseminated various species of insects in widespread areas of Northeast China, and since March 6th, they have extended their activities to areas such as Tsingtao, Shantung Province.

Judging from the circumstances in which insects were found, from their connection with the planes, and from various entomological anomalies, it can be ascertained that such insects were definitely not naturally occurring in those localities, but were undoubtedly disseminated by American planes.

The following are the main reasons for this conclusion.

(1) **Connection with air raids.** These insects were all discovered in places after American planes had intruded into the areas. For instance, in the morning of March 4th, three planes raided Hung-Shih-La-Tze village, K'uan-Tien hsien. In the same afternoon, large quantities of field-crickets were discovered by the inhabitants on the snow-covered ground outside the village. Another instance was the intrusion by one plane early on March 7th along the line between Fu-Shun and Shenyang. Around 10:30 a.m. in the same morning, numerous anthomyiid flies were found at Wu-Li-T'ai Bridge, Ku-Chia-Tze, Shenyang. In another case, one plane intruded into Ch'ang-Pai area after 8:00 p.m. on March 26th, and from the next morning the inhabitants of Chia-Tsai-Shui village of that district discovered successively outside the village three four-compartment bombs. In the neighborhood of these four-compartment bombs there were flies, midges, fleas, field-crickets, springtails and spiders. At 9:00 p.m. on March 6th, an airplane intruded over Tsingtao City and then numerous anthomyiid flies and wolf-spiders were found on the next day along the part of the coast near Shan-Tung-Tou.

(2) **Eye-witnesses.** Not only was the discovery of the insects closely related chronologically to the activities of American planes, but at some places there were also persons who witnessed objects being dropped in areas where insects were found shortly afterwards. For example, on the afternoon of March 6, 1952, Shan Wen-Jung and Tu Kung-Chou, inhabitants of Tung-K'an-Tze, Antung, witnessed four American planes passing over, and about ten minutes later discovered objects dropping down like snow-flakes which after reaching the ground were found to be anthomyiid flies, midges and spiders. On March 12, Han Yung-Pin, a salesman at K'uan-Tien, witnessed the dropping of a bacterial bomb by an American plane. On the next day, numerous anthomyiid flies and wolf spiders were discovered near by the place which was later found to have been the point of impact of the bacterial bomb outside the east gate of that town.

(3) **Anomalies in locality of discovery.** Many of the insects were discovered at those places where they generally should not be found. For instance, springtails should be living in damp places, but on March 4. they were discovered in large numbers on the cement stadium about 6 m. high in a race course at Fu-Shun and on the top of a neighbouring cement silo about 12 m. above the ground. Fleas should be living on hosts, or near the places where the hosts live. However, at Fu-shun and K'uan-Tien, fleas were discovered on the surface of the snow after intrusions by American plànes.

(4) **Seasonal anomalies of appearance.** Most of the insects appeared at the wrong season. For instance, the migratory locust passes winter in the egg stage and the adult dies after laying eggs in the autumn. The eggs hatch out in April and May of the next year. However, at mid-night on March 15 following the intrusion by American planes, a large number of locusts were discovered on cement ground still covered with snow inside the city of Shenyang. In Northeast China houseflies usually begin to make their appearance outdoors in May. Yet on March 17, numerous such insects were discovered outside San-Ho village of Ssu-Ping city.

(5) **Anomaly of numbers of individuals.** Besides the anomalies in season and location, the number of insects discovered also shows important abnormalities. Although it is known that some insects may metamorphose earlier than they should, the number can not be too many. For example, flies which pass the winter as pupae may occasionally metamorphose earlier, but they should certainly not appear in great numbers in one locality especially when it is not their usual breeding place. For example, the anthomyiid flies discovered at Ku-Chia-Tze, Shenyang, were in tens of thousands, and in Ssu-Ping as many as 6000-7000 house flies were found in a single group. Even more outstanding was the discovery of tens of thousands of field-crickets at K'uan-Tien on the surface of the snow. As we know fro mthe habit of field-crickets, it is not only impossible to appear in swarms. Moreover, these insects having the habit of hiding would not expose themselves on the surface of the snow. Therefore one can understand that the appearance of these insects in large populations at the wrong season and at unusual places is very peculiar.

(6) **Anomaly of association.** Insects with similar behaviour and habits can, under natural circumstances, be found in the same place at one time. Anything else is highly improbable. In the districts of Northeast China flown over by American planes, the masses discovered consisted usually of insects with quite different habits. For example, springtails, together with fleas, were found in K'uan-tien. In the vicinity of the four-

compartment bombs discovered near Ch'ang-Pai, midges (*Orthocladius* sp.) were found with field-crickets (*Gryllus testaceus* Walker). "Blue-bottles" (*Lucilia sericata* Meigen) and locusts (*Locusta migratoria* Linn.) were found together in the district of Ma-Lu-Wan, Shenyang.

(7) **Anomaly of geographical distribution.** The places where the insects were discovered are mainly points along lines of communication and all had been flown over by American planes. Nothing like this occurred in other places of the same latitude and the same geographical conditions. It should be emphasized that the area and frequency of the appearance of unusual insect populations were in accordance with the area and frequency of invasion by American planes. As we know, Liaotung province, north of the Ya-lu River was intruded over with the highest frequency and greatest extent; the middle part of Heilungchiang province came next, while the appearance of unusual insect populations was shown to be exactly in the same order. As to the region in between the two districts mentioned above (about north latitude 44°-47°), except Harbin, no such insect population has been observed. This is contradictory to the natural distribution of insects.

From all the above facts, there can be only one explanation, that is, these insects were dropped by American planes.

In Europe, however, two arguments have been brought out, especially in regard to the seasonal anomaly of the appearance of insects. First, it has been argued that the continued napalm bombing might result in a local heating of the earth, which would disturb the normal life-cycles of various insects, and cause their earlier appearance. Secondly, the abnormal appearance of the insects might not be due to meteorological changes, but to some other natural factors in action which caused their earlier appearance. These arguments, however, do not meet the case. First, no napalm bombing has taken place in Northeast China. Secondly, in addition to seasonal anomaly, in many instances, the appearance of insects was abnormal with respect to quantity and location. Thirdly, it is difficult to see why only comparatively few out of the numerous kinds of insects in Northeast China have been affected. One can understand that the response of insects to a certain factor might be different for different species or even for different individuals, but, in a large territory such as Northeast China, the effect could not be limited only to a few species, if general factors such as those upon which the above arguments are based were acting. Let us take anthomyiid fly (*Hylemyia*) as an example. Under this genus, the following species are common in Northeast China: *H. platura* Meigen, *H. antiqua* Meigen and *H. pilipyga* Villeneuve; all these usually appear between April and May. Why did they not also come out earlier under the supposed natural factors? The

same thing holds true for other common species of flies such as the lesser housefly (*Fannia* spp.), which usually appears in April, the ophyra fly (*Ophyra* spp.) and the flesh-fly (*Sarcophaga* spp.), both of which usually appear in May; though under the some condition, they also are uneffected.

B. *Extent of dissemination and species of insects disseminated.*

American planes have disseminated insects over widespread areas in China. In Northeast China, insects were discovered after the invasion by American planes in an area bordered by Na-Ho and Ke-Shan to the North, Chuang-Ho and Fu-Hsien to the South, Ch'ang-Pai and An-Tung to the East, and Fu-Hsin and Chin-Chou to the West. Moreover, insects were also disseminated by American planes in Tsingtao, Shantung province.

The insects disseminated consist of a large number of species with different characteristics, and the following species are to be considered in this report.

(1) Housefly (*Musca vicina* Macquart)
(2) Non-biting stable fly (*Muscina stabulans* Fallen)
(3) Anthomyiid fly (*Hylemyia* sp.)
(4) "Blue-bottle" fly (*Lucilia sericata* Meigen)
(5) Sun fly (*Helomyza modesta* Meigen)
(6) Midge (*Orthocladius* sp.)
(7) Culicine mosquito (*Culex pipiens* var. *pallens* Coquillett)
(8) Aedes mosquito (*Aedes koreicus* Edwards)
(9) Human flea (*Pulex irritans* Linn.)
(10) Ptinid beetle (*Ptinus fur* Linn.)
(11) Grouse locust (*Acrydium* sp.)
(12) Migratory locust (*Locusta migratoria* Linn.)
(13) Field cricket (*Gryllus testaceus* Walker)
(14) Springtail (*Isotoma negishina* Börner)
(15) Wolf spider (*Tarentula* sp.)

From the general point of view, these insects form a highly heterogeneous group. Among them, there are insects which are well-known in medical entomology, such as houseflies and "blue-bottle" flies, and insects which are important pests in agriculture, such as locusts and field-crickets. In addition, there are insects which are previously considered as of little ecomonic importance, such as sunflies and springtails.

II. CONSIDERATIONS BY SPECIES

(1) House fly (Musca vicina Macquart)

A. *Discovery*:

On March 14th, 1952 at 10 p.m. American planes intruded into Ssuping area. In the afternoon of March 17th, Wang Yu-Tsai, an inhabitant

of San-Ho village, First District, Ssu-ping city, discovered a large number of house-flies on the sandy ground at San-Tao-Lin-Tse outside the village. On the next day, the district government mobilized the village inhabitants and wiped out 6000-7000 flies.

B. Identification.

Scientific name: *Musca vicina* Macquart.
Order Diptera, Family Muscidae.

Identified by: Chin Yao-ting, Professor, National Medical College.
Feng Lan-pin, Lecturer, National Medical College.

Very similar to *M. domestica* in appearance. Mesonotum with four well defined dark stripes. Male, width of front about one fourth to one third of that the eye; abdominal terga orange, with a broad median black stripe. Female, width of front slightly narrower than that of the eye; abdomen resembling the male except the first, second and third terga which are dark orange and with greyish yellow tomentum. This species differs from *M. domestica* only in the width of the front and the shape of the genitalia.

C. Bionomics.

It is widely distributed in China, Korea, Japan, Iran, India, Mediteranean region, Egypt, Australia, and America. It is the commonest species in Hawaii (Essig, 1942).

Its biology is very similar to that of *M. domestica.* They breed in excrements, garbage manure, and decaying organic matters. In Tsinan, Shantung, they were observed to breed in the period from June to October (Meng and Winfield, 1943a). There are many generations a year depending upon local climatic conditions. In July and August, it needs about 10 days to complete the life cycle of one generation (Meng and Winfield, 1943c). In North China, this species passes the winter in pupal stage (Feng, 1951). The adults frequent houses.

D. Discussion.

In North China, the adult usually appears in May. According to Meng and Winfield (1941b), in Tsinan, Shantung, this fly begins to appear in May. At the same place they have collected all the flies invading a single house throughout one year. On analysis of a total of 1831 flies collected, the housefly was found to be 91.77%, yet not a single specimen appeared in the period from January to April. In Peking, Feng (1951) has obtained the same results. He found that the fly passes winter as pupa and the adult dies in the winter if house is not artificially heated. The overwintered pupa begins to emerge in the beginning of May.

The adults of *M. domestica* according to the records in foreign countries, also begin to appear in late spring. For instance, at Sendai, Japan, the adults appear in the middle of May (Hori 1949 and 1950). Observations made by Graham-Smith (1916) in Cambridge, England have shown similar results.

Northeast China is much colder than Tsinan. At Ssu-Ping, the average temperature in March, 1952 was 1.4°C below zero. Based on the above-mentioned observations, the earliest appearance of this fly should be in May. However, on March 17, 1952, large numbers of these flies were discovered in the open field at Ssu-Ping. This is evidently anomalous, and closely connected to the activities of the American planes.

Bacteriological examination of the houseflies dropped by American planes showed that they carried anthrax bacilli.

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(2) Non-biting stable fly (Muscina stabulans Fallen)

A. *Discovery*:

Non-biting stable flies were discovered following the intrusion of American planes in the areas of An-tung, K'uan-Tien, and Shenyang. For instance, on March 4, 1952 six American planes invaded K'uan-Tien after which non-biting stable flies, fleas and springtails were discovered on the snow out side the south gate by Li Jun-chih, an inhabitant of the third Lü of that county, on his way to the south gate.

B. *Identification*:

Scientific name: *Muscina stabulans* Fallen.
Order Diptera, Family Muscidae.

Identified by: Ch'en, Sicien H. Director, Laboratory of Entomology, Academia Sinica.
Lu Pao-lin Assistant Professor, Department of Entomology, Peking College of Agriculture.

Resembling the common house fly in general appearance, but larger and more robust, about 7-9.5 mm. in length. Arista plumose, bearing hairs on both the upper and lower sides. Thorax grey, with four longitudinal black stripes on the mesonotum; scutellum tipped with orange tint. Fourth longitudinal vein not elbowed, converging but slightly towards the third. Legs slender, reddish or yellowish brown in color. Abdomen almost black in color, covered with grey in places, giving it a patched appearance.

C. *Bionomics*:

The non-biting stable fly is a widespread almost cosmopolitan species and is also recorded in China (Ouchi 1938, Wu 1940). The eggs are laid upon decaying orangic matter and excrement, including human and rotting cow dung, in which the larvae develop. The adults enter houses as well as stables and other farm out-buildings. In North China, it hibernates mainly in pupal stage and the adults hatch from the over wintering pupae in about the middle of April (Feng, 1951). Observations were also made in Peking and its vicinity, it was found that the fly was still in the pupal stage in the middle of April. In Sendai, Japan, this fly begins to appear at about the end of April (Hori, 1949) while in Kyoto of the same country, they were observed in the years of 1933 to 1935 to appear even later, in May (Ando, 1936).

D. *Discussion*:

Judging from the time of appearance of the non-biting stable fly under natural conditions, we can see that in Northeast China the earliest

time for the adults of this fly to appear should be the end of April. However in Shenyang, Antung and K'uantien they were discovered early in March in abundance outdoors and on snow fields following the intrusion of American planes. Obviously this is abnormal.

Bacteriological examinations showed that typhoid bacilli were isolated from the non-biting stable flies dropped by American planes.

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(3) Anthomyiid fly (Hylemyia sp.)

A. *Discovery*:

Large numbers of Anthomyiid flies were found in An-Tung, Shenyang, K'uan-tien, and Tsingtao following the invasion by American planes. For example, shortly after 3:00 p.m., March 6, 1952, Shan Wen-jung and Tu Kung-Chou, staff members of the 5th District Government of Tung-Kan-Tze, An-Tung City, witnessed four American planes flying southward, and, about ten minutes later, saw objects falling down like snowflakes, which when reached the ground, were found to be anthomyiid flies, midges, and spiders. People were mobilized to make a thorough search, and the same arthropods were found on the nearby hills and house roofs.

On March 7th, after an American plane intruded into the air of Shenyang and Fushun, a railroad worker of Ku-Chia-Tze station, Shenyang, while inspecting the tracks, found large numbers of anthomyiid flies around Wu-Li-Tai bridge.

On March 12th, Han-Yung-Pin, a salesman saw a bacterial bomb actually dropped by an American plane. From the next day on, a large

number of anthomyiid flies and wolf spiders were suddenly found in places around Lou-Ho-T'ao outside the east gate.

B. *Identification*

Scientific name: *Hylemyia* (*Chortophila*) sp.
Order Diptera, Family Anthomyiidae.

Identified by: Chen, Sicien H. Director, Laboratory of Entomology, Academia Sinica.

Lu Pao-lin, Assistant Professor, Department of Entomology, Peking Agricultural University.

The anthomyiid flies found in Shenyang, Antung, K'uan-Tien, and Tsingtao all belong to one species of the genus *Hylemyia*. This genus contains many species, for example, Séguy, in 1937 gave a list of 559 species. The following fifteen species were recorded in China (Séguy 1937, Wu 1940, Kato 1939, 1949):

(1) *H. angustissima* (Stein)—Hsitsang (Tibet)
(2) *H. antiqua* Meigen—Hopei, Inner Mongolia, and NE China
(3) *H. bisetosa* (Stein)—Hsitsang (Tibet)
(4) *H. depressa* (Stein)—Hsitsang (Tibet)
(5) *H. femoralis* (Stein)—Hsitsang (Tibet)
(6) *H. floralis* Fallen—Shensi, NE China
(7) *H. gracilis* (Stein)—Hsitsang (Tibet)
(8) *H. latigena* (Stein)—Hsitsang (Tibet)
(9) *H. longirostris* (Stein)—Hsitsang (Tibet)
(10) *H. nigribasis* (Stein)—Hsitsang (Tibet)
(11) *H. pilipyga* Vill.—Inner Mongolia, NE China
(12) *H. platura* (Meigen)—Hopei, Inner Mongolia, NE China
(13) *H. spinicosta* (Stein)—Hsitsang (Tibet)
(14) *H. subcilicrura* Séguy—Shanghai
(15) *H. tibetana* Schnabl and Dziedz—Hsitsang (Tibet)

Though the anthomyiid fly discovered has not been identified to species, it is certain that it differs from any of the fifteen species mentioned above. This genus of fly has attracted people's attention, especially in Northeast China (Kato 1939, 1949), because it includes several important pests on crops. This species, however, has never been recorded.

Length of body, 5-6 mm.; length of wing, 5.5-6.5 mm.

Body black, densely pubescent; propleura and hypopleura without bristles; acrostichals 1 pair and dorsocentrals 2 pairs before transverse suture; sternopleurals 1: 2; tibiae II with bristles on all sides. Arista almost bare. Head greyish tomentose, thorax and abdomen brownish-grey tomentose; mesonotum with 3 dark longitudinal stripes the middle one

being broader; abdomen more or less flattened, with a median dorsal dark stripe. Wings hyaline, darkened at base; anal vein more or less obsolete toward apex. Male: eyes almost contiguous. Female: interocular space much broader about twice the width of the eye. Hypopygium long and slender.

C. *Bionomics:*

As the present anthomyiid fly has not been identified to species, it is impossible to know exactly its bionomics. There are great variations in behavior and habits among the numerous species of this genus. The larvae are saprophagous, scatophagic or omniphagic; very few are parasitic. Those which feed on plants usually damage crops, for example, *H. brassicae* (Bouche), *H. platura* (Meigen), etc. Adult flies frequent flowers, grass and leaves; they may also be found at places where the larvae breed.

For the same reason, it is impossible to know exactly the season in which this anthomyiid fly appears under natural conditions. As a reference, those of a few representative species of the genus are given below.

(1) *H. antiqua* Meigen: In Korea, the adults first appear late in April and abundant only in May (Yoko-o, 1940). In England, according to Smith (1922), the adult flies of the same species generally first appear in May, though some individuals may occasionally hatch out in winter time. The occurrance of this fly in large numbers in the field only happens in about June.

(2) *H. brassicae* (Bouche): It has not been recorded from China. In England, adults of this species hatch out at the end of the second week in May. The earliest date of its appearance recorded for the year 1926 was May 14th (Smith, 1927). In Chicago, adults of the same species appear in May (Metcalf and Flint 1951). Ecologically and geographically Chicago corresponds with Tsi-Nan of Shantung Province in China, where the weather is warmer than Northeast China.

(3) *H. platura* (Meigen): According to our observations, in the northern part of China adults flies normally appear in May, though a few individuals may hatch out late in April. Similarly, according to Metcalf and Flint (1951), at places in middle United States on the same latitude as Illinois, the adults begin to make their appearance also in the beginning of May.

(4) *H. pilipyga* Vill: In Northeast China, the adult flies appear around May and June (Kato 1939, 1949).

D. *Discussion:*

From the data given above, it is clear that the anthomyiid flies make their appearance in the late spring; especially in Northeast China, the known species of this group of flies will not appear until sometime in April and May. But in the case under discussion, it was in the beginning of March when the weather was cold and the ground was covered with snow, large numbers of this species of anthomyiid flies were found in the open on the ground or on the snow at Shenyang, K'uan-tien, Antung and other places in Northeast China following the invasion by American planes. Furthermore, the actual dissemination of this species of flies by American planes has been witnessed in Antung. The same also happened in Korea, and the finding of this species of anthomyiid fly dated as early as January 28th. It is clear therefore that not only this fly has repeatedly been found in large quantities at low temperature on snow surfaces, but also that the first appearance of the fly in northern part of Korea is more than one month earlier than that in Liaotung Province, Northeast China, although these places are geographically so close together. These phenomena are undoubtedly abnormal. Furthermore, anthrax bacilli have been found in the anthomyiid flies dropped by American planes.

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(4) "Blue-bottle" fly (Lucilia sericata Meigen)

A. Discovery.

Around 9:40 p.m. March 15th, 1952, after the invasion of Shenyang City by American planes, Sun Chia-Hsün, a public security guard, and Chang K'uei-Piao, a firemen of the Nan-shih District, witnessed, at the same time but from different spots, glistering objects falling from the air over the area south to Ma-Lu-Wan. Immediately afterwards, numerous "blue-bottle" flies were discovered over and around the dormitory at places such as the cement playground, still covered with snow, of the Ministry of Trade, Northeast China People's Government. Together with these "blue-bottle" flies, non-biting stable flies, locusts, grouse locusts, etc. were also discovered.

B. Identification.

Scientific name *Lucilia sericata* Meigen
Order Diptera, Family Calliphoridae.

Identified by: Feng Lan-Chou, Professor, Department of Parasitology, China Union Medical College
Chao Chen-sheng, Assistant Professor, Department of Parasitology, College of Medicine, Peking University

Commonly known as "blue-bottle" flies, with a yellowish-green cuprenous color characterized by: basicostal scale yellow, sternite without tuft of long hairs, arista plumose to the tip, and 3 pairs of postsutural acrostichal bristles on the dorsal side of the thorax. Body length: 6.0-9.5 mm.

C. Bionomics.

"Blue-bottle" flies are found in Europe, North America, Australia and Japan. They have also been recorded in China. This fly breeds in putrefied animal tissues such as putreüed meat and animal corpses, etc. The larva has been found in the feces of chickens and pigs. The life cycle takes about twelve days at 80° F (26° C). The adult flies are especially active in clear and warm days, and usually gather over putrefied refuse. Occasionally they are found on flowers and leaves of various plants and may fly into rooms. It passes winter in the pupal stage.

D. Discussion.

According to the work of Graham-Smith (1916), in Cambridge, England, *Lucilia* appears in early May. And according to Hori (1949) this fly usually occurs in the period from April to October in Sendai, Japan. In North China, for instance Peking, they appear in early May, being most abundant in June and July. The weather in Northeast China is colder than that in Peking. Hence the sudden appearance of this fly in abundance in March on snow covered cement playground is obviously abnormal.

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Wu, C. F. 1940 Catalogus Insectorum Sinensium. Vol. 5. Diptera and Siphonaptera. Peking: Fan Mem. Inst. Biol., 524 pp.

(5) Sun fly (Helomyza modesta Meigen)

A. Discovery.

Large numbers of sun flies were discovered in Chin-chow, An-tung, Fu-shün and K'uan-tien, after the invasion by American planes. For example, on March 4th, 1952, an American plane intruded into the air of Chin-chow, and from March 5th on, Jen Tsan-I and Yueh Ching-lin, inhabitants of Fan-chia-tün and La-la-tun, villages of Chin-chow, found successively in those districts a large number of sun flies; as well as midges and spiders.

B. Identification.

Scientific name: *Helomyza modesta* Meigen
Order Diptera, Family Helomyzidae

Identified by: Chen, Sicien H., Director, Laboratory of Entomology, Academia Sinica
Lu Pao-lin, Assistant Professor, Department of Entomology, Peking Agricultural University.

Small blackish fly with greyish tomentum, body length 3-4 mm. Head yellowish or reddish brown, legs of a black colour more or less mixed with red. Post vertical bristles convergent, there are 2 vibrissal bristles on each side. Wings with the costal spines well-developed, mesopleural bristles 1 or 2; sternopleural 1. Abdomen oval oblong; tergite VIII, thickened and of a red colour.

C. Bionomics.

H. modesta Meigen is found in Germany, Hungary, and Italy etc., not been recorded in China.

Its life history has not been thoroughly studied. Sun fly breeds on excrements and decaying organic substances. Many live in caves, and some can be found on house windowpane. According to our observation, flies of this family first appear in April this year in Peking, but is not found in considerable number until early summer.

D. Discussion.

Since the weather of Northeast is cooler than that of Peking, the appearance of sun fly should be later than that in Peking, and, of course, should not appear in large quantity on snow. So the sudden appearance of these flies in large quantity in cold weather or on snow and ice surfaces, in Chin-chow, Fu-shun, K'uan-tien etc. after the invasion by American planes, is obviously abnormal. Bacteriological examinations showed that the sunflies, *Helomyza modesta* disseminated by American planes carried paratyphoid bacilli.

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(6) Midge (Orthocladius sp.)

A. Discovery.

Midges were discovered in Chin-chow, An-tung, K'uan-tien, and Ch'ang-pai following the intrusion by American planes. For instance:

On March 4th, 1952, an American airplane invaded Chin-chow. Since the 5th March, large numbers of midges were discovered successively at Fang-chia-tun, La-la-tun etc. of Chin-chow by Jen Tsan-Yi and Yüeh Ching-lin, local inhabitants. At the same time, sun flies and spiders were also found.

On March 6th, 1952, at about 3:00 p.m., Shan Wen-jung and Tu Kung-chow, officers of the 5th District Government, Tung K'an-tze, An-tung City, witnessed four American planes flying southward. Ten minutes later, objects were seen dropping down like the falling of snow, which upon reaching the ground were found to be midges, anthomyiid flies, and spiders. Upon searching, these insects and spiders were also found on the hills and roof tops.

On March 26th, 1952, after 8 p.m., an American plane intruded into the district of Ch'ang-pai. Since 27th, inhabitants in Chia-tsai-shui Village, discovered successively three four-compartment bombs in and outside the village. In the neighbourhood of these four-compartment bombs, large numbers of midges were discovered. At the same time, field crickets and spiders, etc. were also found.

B. Identification.

Scientific name: *Orthocladius* sp.
Order Diptera, Family Chironomidae.

Identified by: Liu Ch'ung-lo, Professor and Head of Department of Entomology, Peking Agricultural University.

The midges discovered in An-tung etc. belong to Genus *Orthocladius*. The species name is to be determined. This genus of midge has been recorded in the sub-continent of China. According to a preliminary survey, only one species is found in Ho-pei and Ping-yuan provinces. Its larvae are pests of wheat crops or its like plants. It is quite different from the species dropped by American planes.

The present species is characterized as follows: Brownish black; body length: male 3.4-4.8 mm., female 3.1-4.0 mm. Antenna 14-segmented in male, 6-segmented in female. Eyes naked.

Maxillary palpus 4-segmented. Wing membrane with microtrichae. R2+3 and R4+5 separate; R2+3 slightly closer to R1 at wing margin; cubital fork behind r-m; m-cu absent; Cu2 slightly bent beyond middle with apical end curved forward and not reaching the wing margin; anal vein extending far beyond cubital fork; squama fringed. First tarsal segment of front leg shorter than tibia; middle tibia with spur but no pecten; hind tibia with 2 spurs, the inner long and outer one short, pecten present; first and second tarsal segments of middle and hind legs each with a minute spur; the 4th tarsal segment longer than the 5th. Ninth abdominal tergite with a smooth anal point; coxites with long hairs on the outer margin and a bluntly rounded lobe a little above the middle on the inner margin; style long, narrow, dipper-shaped, with a short blunt appendage near the apex.

C. Bionomics.

The larvae of this genus breed chiefly in running or stagnant water; only a few are terrestrial, still they select damp earth as their breeding ground. The adults of some species may appear in March at a temperature below freezing point and may move about on the surface of snow (for examples: *Orthocladius nivium* Kieffer; *O. nivosus*, Kieffer etc.).

Although the larvae of *Orthocladius* are living on bacteria, up to 1946, there has been no determination of the percentage of bacterial infection for these midges nuder natural conditions. Brimley and Steinhaus have proved that the larvae of the genus *Chironomous* can be experimentally infected with bacteria (*Serratia marcescens* Bizio). The infection is not affected by the metamorphosis of the host and the bacteria can be transmitted by the emerged adult.

D. Diseussion.

In An-tung, K'uan-tien, Chin-chow, and Ch'ang-pai, midges were discovered after the intrusion of American planes. In some of the places, they should not appear under natural conditions. For example, those discovered all of a sudden in large numbers at Ssu-ping-chieh Village,

Chang-tien Town of K'uan-tien Hsien were found on a dry sandy dune devoid of any grass or water in the vicinity. On the contrary, in places such as Yang-mu-ch'uan in K'uan-tien and Ha-ma-tang in An-tung, which are suitable for their breeding and are in the neighbourhood of the localities where midges have been found in large numbers, no such insects have been found. Even more unusual is the fact that in many places, they were found together with spiders and field crickets etc. which have entirely different habits from those of the midges, they have even been found beside the four-compartment bombs at Chang-pai Hsien.

Bacteriological examination of the midges dropped by American planes showed that they carried typhoid bacilli.

Reference

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(7) Culicine mosquito (Culex pipiens var. pallens Coquillett)

A. *Discovery.*

Around 9:40 p.m., March 15th, 1952, after the intrusion of Shenyang City by American planes, Sun Chia-Hsün, a public security guard, and Chang K'uei-Piao, a fireman of the Nan-Shih District, witnessed, at the same time but from different spots, glistering objects falling from the air over the area south to Ma-Lu-Wan. Immediately afterwards, numerous culicine mosquitoes of both sexes were discovered over and around the dormitory in places such as the cement playground and veranda of the Ministry of Trade, Northeast China People's Government. Together with these culicine mosquitoes, locusts, grouse locusts, "blue-bottle" flies and non-biting stable flies were also discovered.

B. Identification.

Scientific name: *Culex pipiens* var. *pallens* Coquillett.
Order Diptera, Family Culicidae

Identified by: Ch'in Yao-t'ing, Professor, National Medical College, Shenyang

A medium sized yellowish brown mosquito characterized by:—ventral cornu of the lateral plate of phallosome very broad and plate-like, median process stout, blunt at tip, (differing from typical *pipiens* of which the ventral cornu is pointed). Lateral arm of tenth sternite short, narrow. Proboscis and tarsi not banded. Abdominal tergites with narrow pale bands at the base. Femora and tibiae not banded or striped.

C. Bionomics.

This species is found in East Africa (Patton and Evans, 1929), California, U.S.A., Japan (Hsiao and Bohart, 1946), Korea (Hsiao, 1946) and China (Chin, 1936; Ho, 1931; Wu, 1940), etc. In North China it breeds in water containers, and in the polluted water of drains and ponds. Occasionally it breeds in rice fields.

The adult mosquito is usually seen in human residence, being more active at night. In daytime it hides itself in dark places. It prefers human blood, and is therefore an annoying insect.

In Peking this species appears in May, being most prevalant in June. July and August, and decreases in number gradually after October. The male dies in winter, while the female passes the winter by hiding itself in damp, dark and warm rooms.

D. Discussion.

This mosquito was discovered outdoor at midnight on March 15th. at a temperature of 10°C below zero. Under such conditions it was impossible for them to appear naturally. Furthermore, in this mosquito it is the female mosquito that passes the winter, but the mosquitoes discovered in this incident consisted of both sexes. Hence, we can assure that it is impossible that these mosquitoes which appeared in March were of local origin.

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(8) Aedes mosquito (Aedes koreicus Edwards)

A. Discovery:

On March 15th, 1952, at 9:00 p.m. American planes intruded the air of Tieh-Ling. On the 19th, Wu Feng-chih, a worker of the Tieh-Ling station discovered in the neighborhood of station large numbers of aedes mosquitoes and midges.

B. Identification:

Scientific name: *Aedes koreicus* Edwards
Order Diptera, Family Culicidae.

Identiüed by: Ch'in Yao-ting, Professor, National Medical College, Shenyang.
Chang Tsung-pao, Director, Laboratory of Mosquito and Fly Research, Institute of Hygiene, Dairen.

Aedes koreicus is a medium-sized blackish mosquito, with the following characteristics: Proboscis long and slender, longer than front femora. Maxillary palpi of male insect slightly shorter than the proboscis. Mesonotum with five yellowish stripes of which the central one is the broadest, forking just in front of the scutellum. Lateral to it being two shorter stripes on each side, the outermost of which are somewhat arched. First four tarsal segments of hind leg pale-ringed at base.

C. Bionomics:

Aedes koreicus is distributed in Japan and Korea (Hsiao, 1946; Hsiao & Bohart, 1946). It is also recorded in China (Ho, 1931; Feng, 1933; Wu, 1940).

Their larvae are found in water accumulated in those places such as flower pot, water jars, etc. in the neighbourhood of houses. Excavations of rocks and small pits are also breeding places of this species of mosquitoes. The adults suck blood from man or dogs at night but they may occasionally do so in day time. In North China, they pass winter as eggs (Feng, 1937). Kobayashi (1933) had the same observation in Korea. The eggs can resist extreme cold, dry and other adverse conditions, but all the adults, larvae and pupae die in winter.

D. Discussion:

Under natural conditions, *Aedes koreicus* passes winter in egg stage and in Shenyang the adults will not appear until the end of May. Therefore the discovery of such mosquitoes on March the 19th, in Tieh-ling following the intrusion by American planes is evidently not a natural event.

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(9) Human flea (Pulex irritans Linn.)

A. Discovery:

In Fu-shun and K'uan-tien insects such as fleas, sun flies, midges were discovered in fields, on the surface of snow and other spots following the intrusion by American planes. For instance, on March 2nd, 1952 twelve groups of American planes in succession intruded Fu-shun, An-tung and other places. On the same day after the air raid Li Shu-k'u, an inhabitant of Ta-kou Village, Fu-shun City, on her way to Li-jen Village discovered numerous fleas in the snow covered field. The average temperature in Fu-shun for that day was 6.2°C below zero.

B. Identification:

Scientific name: *Pulex irritans* Linn.
Order Siphonaptera, Family Pulicidae.

Identified by: Feng Lan-chou, Professor, Department of Parasitology, China Union Medical College, Peking.
Chao Chen-sheng, Assistant Professor, Department of Parasitology, College of Medicine, Peking University.

Pulex irritans Linn. is characterized as follows: General colour dark brown, eyes present, genal and pronotal ctenidia absent, labial palpi reaching about half length of fore coxa, an ocular row of two bristles,

hind femur with a row of seven or more spines inside. Mesopleuron narrow, without internal rod-like thickening from the insertion of coxa upward. Fifth hind tarsal segment longer than second.

C. Bionomics:

Human fleas are found all over the world, and has also been recorded in China. The adult is a temporary ecto-parasite of warm blooded animals including men, cats, dogs, rats, etc. Both the male and female suck blood, may change from one host to another at any moment, and are carried to different places by the movement of the host. The adult flea lives rather long. According to experimental record (Bacot, 1914) at the temperature of 40-50°F with nearly saturated moisture in the air, the fed fleas can live for 513 days while under starvation they can live for 125 days.

D. Discussion:

Human fleas are generally found on the body or near the resting places of their hosts. Now in places like Fu-shun and K'uan-tien they were suddenly discovered on the surface of the snow in the fields, following the intrusion of American planes. Undoubtedly they were disseminated by American planes.

Reference

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(10) Ptinid beetle (*Ptinus fur* Linn.)

A. Discovery:

On March 20, 1952, two American planes intruded into the Liaoyang district. Inhabitants of Pei Chiao Ch'ang Village, Liaoyang Hsien saw a reddish object of the size of a thermos bottle falling down from the air. Large numbers of ptinid beetles were soon found outdoors on the wall, ground and field. Discovery of these beetles was also made in the neighbouring Anshan city area.

B. Identification:

Scientific name: *Ptinus fur* Linn.
Order Coleoptera, Family Ptinidae.

Identified by: Liu Chung-lo Professor, and Head of Department of Entomology, Peking College of Agriculture.

Lu Pao-lin Assistant Professor, Department of Entomology, Peking College of Agriculture.

Ptinus fur is a small beetle. Sexes dimorphic: male, 3.4-4.4 mm. in length, body elongate-ovate in shape with very long antennae; female, body ovate with antennae much shorter. Characterized chiefly by the presence of, on each side of the disk of the pronotum, a yellowish brown, subtomentose cushion; and the presence on the elytra of longitudinal rows of punctures with fine brownish hairs, and a white hairy band near the base and another before the apex.

C. Bionomics:

Ptinid beetle is widely distributed all over the world. According to Hsin (1951) and Kuan (1952), its occurrence in China has been recorded. They are storage pests. According to Hsin (1951), Li (1952), Cotton (1947), Hayhurst and Britten (1942) and Shepard (1947), under natural conditions they are mostly found in warehouse, granary, flour mill, or factories and storehouses for animal and plant products, causing damages to the stored grains, flours, furs, and leathers, etc. They are also a well-known museum pest, destroying especially dried animal and plant specimens (Curran, 1925; Patton, 1931).

It has one to three generations each year, depending upon climate. In China, it generally overwinters in the larval stage, but occasionally as adult. Each generation requires about three and half months. The adult is active at night, retiring into hiding places during the day, and has the habit of death-feigning.

D. Discussion:

A comparison of the circumstances under which the ptinid beetles were found in Liaoyang and Anshan, with their natural behavior, makes the following four points noteworthy:

1. Ptinid beetles should be found in warehouses, especially in those for the storage of grains, flours, furs and leathers, or other places where these materials are kept. However, in Liaoyang and Anshan Hsien, they were found outside dwellings instead of around warehouses. They were not only found outdoors on the ground and walls, but also in the fields. This phenomenon is definitely unnatural.

2. As mentioned in the literature, ptinid beetles are nocturnal. However, at Liaoyang, they were discovered in daytime in the field where they should not appear normally. This is at variance with their ordinary behavior.

3. A survey of the areas from which ptinid beetles had been collected revealed within the region the absence of storehouses for grains, furs, leathers or other materials, and of circumstances in the dwellings which might have caused the multiplication of ptinid beetles in large numbers. Under natural conditions, therefore, it is impossible for such quantities of ptinid beetles to appear at the places of discovery.

4. Subsequent to the sudden appearance of large numbers of ptinid beetles in Pei Chiao Chang Village, Liaoyang, on March 20, 1952, an investigation was made in order to find out further the possibility of natural occurrence of ptinid beetles in such likely places as storehouses for grains, etc. in the vicinities of Liaoyang and Shenyang. As a result no presence of these beetles was revealed. It is, therefore, readily concluded that the appearance in quantities of the ptinid beetle in Liaoyang and other places is neither natural nor due to migration or dispersion from neighbouring regions.

It is evident from the four points discussed above that at that time no ptinid beetles had appeared at places where they might naturally occur, while on the contrary they suddenly appeared in large numbers after the intrusion of American planes at places as Pei Chiao Chang Village, Liaoyang, where natural conditions did not permit their appearance. Therefore, from the entomological point of view, the appearance of ptinid beetles in Liaoyang is entirely abnormal.

Bacteriological examinations revealed that these beetles carried anthrax bacilli.

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(11) Grouse locust (Acrydium sp.)

A. Discovery:

Around 9:40 p.m., March 15th, 1952, after the intrusion of Shenyang City by American planes Sun Chia-hsün, a public security guard, and Chang K'uei-piao, a fireman of Nan-shih District, witnessed, at the same time but from different spots, glistering objects falling from the air over the area south to Ma-lu-wan. The Ministry of Trade of the People's Government of Northeast China made searches in the very night after it had been notified of this observation. Grouse locusts, together with migratory locusts, "blue bottle" flies and non-biting stable flies, were found on the cement ground and on the verandah of the second floor of the dormitory building of the Ministry of Trade and in the nearby streets.

B. Identification:

Scientific name: *Acrydium* sp. Order Orthoptera, Family Acridiidae.

Identified by: Ch'in Yao-t'ing, Professor, National Medical College, Shenyang.

Size small, measuring about 6.8 mm. in length, 2.4 mm. in width. Head inclined downwards; vertex usually broader than the eye and is slightly protruding in between the eyes. Antenna longer than the head, with 12-14 segments. Pronotum well developed, and the ridge produced posteriorly reaching nearly to the tip of hind femora. Hind femur well-developed, nearly as long as the tibia, and is ornamenated with dark brown spots. Hind tibia long, slender, spiny and with four spurs at the tip. General coloration pale brown, pronotum with a few or without black spots.

C. *Bionomics:*

Under natural conditions, this group of insects frequents shaded places, and passes winter as adult or mature nymph. They may remain active if kept in the insectorium. During hibernation they hide themselves in shaded grassy grounds or in heaps of fallen leaves at the base of bushes and weeds. In Peking, the hibernating adults may appear in April. Their ova require a certain number of days to mature. Then they mate, the females lay their eggs and the adults die. The nymphs develop slowly, they shed their skin 5-6 times before reaching the adult stage.

D. *Discussion:*

Under natural conditions at Shenyang this species should appear during the middle or last ten days of April. However, in the night of March 15th, when the temperature was still ten degrees Centigrade below zero, large numbers of this insect suddenly appeared after the intrusion of American planes. They were found at such unnatural places as on the verandah of the second floor of the dormitory building and on the cement ground in the courtyard of the Ministry of Trade, in the streets, and other nearby places. Moreover, they were found together with migratory locusts, "blue-bottle" flies and non-biting stable flies. The abnormal appearance of the grouse locust in season and in localities together with the activity of the intruding American planes all speak to the fact that this insect together with migratory locust, the "blue bottle" fly and the non-biting stable fly, were all disseminated by American planes.

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(12) The Migratory locust (Locusta migratoria Linn.)

A. *Discovery:*

Around 9:40 p.m., March 15th, 1952, after the intrusion of Shenyang City by American planes, Sun Chia-hsün, a public security guard, and Chang K'uei-piao, a fireman of Nan-shih District, witnessed, at the same time but from different spots, glistering objects falling from the air over the area south to Ma-lu-wan. Migratory locusts were then found on the verandah of the dormitory of the Ministry of Trade of the People's Government of Northeast China, and in its neighboring areas. Together with the migratory locusts, non-biting stable flies, "blue-bottle" flies and grouse locusts were also found.

B. *Identification:*

Scientific name: *Locusta migratoria* Linn.
Order Orthoptera, Family Acridiidae.
Identified by: Chen, Sicien H., Director, Laboratory of Entomology, Academia Sinica.
Lu Pao-lin, Assistant Professor, Department of Entomology, Peking Agricultural University.

Male: body length, 40-50 mm.; wing length, 42-54 mm.

Female: body length, 42-55 mm.; wing length, 46-56 mm.

Adults of both sexes yellowish to dark brown in general, mandibles black. Pronotum with a prominent dorsal carina, and a black stripe on each side. Antenna long, filiform, with 26 segments; scape and pedicel short but large; other segments long and slender except the terminal one which is short. Face nearly perpendicular in lateral view. Front margin of prothorax straight; hind margin rounded. Fore wing long and narrow, marked with brown spots, and extended far beyond the abdominal tip, the extended part reaching two fifths of abdominal length in average. Hind wing membranous, broad, transparent, and pale yellow. Hind tibia with spines, pale brown in majority and red in few of the specimens examined. Hind femur slightly shorter than half of the fore wing.

C. *Bionomics:*

In North China there are generally two generations a year. If the weather at the end of autumn is high in places of southern Kiangsu and

Chekiang provinces a third generation nymphs may be produced, though they can never develop into adults due to the attack of frosty weather. Ordinarily the overwintering eggs hatch in between April and May. They are the first generation nymphs, called summer locust. About forty days later, the nymphs emerge into adults. Thus the adult locusts may appear from mid-June to early July. They begin to lay eggs about 15 days after emergence. The egg stage lasts 2 to 3 weeks. This is the second generation nymphs, called autumn locusts which appear in about mid-July. These nymphs develop into adults in mid-August to early September. Then oviposition takes place in one or two weeks after emergence. Not long after egg-laying, all the adults die. The egg masses are deposited in soil to pass winter.

In China, the migratory locusts occur mostly on waste lands along the banks of rivers or on strands of lakes. They occur also on alkaline lands, salt fields and sea beaches where weeds are usually abundant. On account of the limitations by the heavy rainfall (more than 1,000 mm.) in places south of the Yangtze River (28° N. latitude) and by the low temperature (in winter the average being below -4°C and the average minimum being below –10°C) in places north of Peking and Chinhuangtao, migratory locust has never been recorded for these areas where only a few solitary locusts may sometimes be found sporadically among weeds in July, August and September.

D. Discussion:

The migratory locust is one of the important pests in China. Studies on its biology and breeding places have been carried on more than 30 years. According to our knowledge, under natural conditions the gregaria phase of this locust is impossible to appear in Shenyang. Although the solitary phase may occur in fields and areas covered with weeds in July, August and September, yet it is entirely impossible to be found in such cold season as the temperature was –10°C, and on the frequently cleaned second storey verandah inside the city. However, they did appear in the night following the intrusion of American planes. Moreover, the dropping objects from the airplane had been witnessed. It is therefore concluded that the appearance of these locusts was closely related to the intrusion by American planes.

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(13) Field Cricket (*Gryllus testaceus* Walker)

A. Discovery:

On March 4th, 1952, after 10 a.m., three American planes intruded Hung-Shih-La-Tze Village, Sixth District, K'uan-Tien Hsien. Yü Chi-Yuan, a teacher of the First District Primary School, with his students Pai Pao-Kuei and others, discovered at about 4 p.m. on the same day a large number of cricket-like insects on the snow-covered ground along the southern bank of a river, about half kilometer away from their school. They picked up a few with twigs for close examination and they found that the insects were almost in a state of stupor but the legs could still move. The area of dissemination was about 2000 square meters with a maximum density of about 10-20 individuals per square meter. They therefore reported immediately to the District Government which verified the discovery. These insects were later identified as *Gryllus testaceus* Walker. According to the record of An-Tung Observatory, the average temperature on that day was -7.2°C.

Again, on March 26th, after 8 p.m., an American plane intruded the district of Ch'ang-Pai. Since 27th, inhabitants in Chia-Tsai-Shui Village discovered one after another three four-compartment bombs in and out-

side the village. In the neighbourhood of these four-compartment bombs, crickets, midges, etc. were found. The former were later identified as *Gryllus testaceus* Walker.

B. Identification:

Scientific name: *Gryllus testaceus* Walker.
Order Orthoptera, Family Gryllidae.

Identified by: Chu Hung-Fu, Vice Director, Laboratory of Entomology, Academia Sinica.

This species has long been recorded as *Gryllus mitratus* Burmeister both in China and Japan. However, according to Shiraki (1936), *Gryllus mitratus* is found in Taiwan Province only and comparatively few in number. The field cricket of China and Japan should be *Gryllus testaceus.* The difference between these two species is: in *mitratus,* as described by Burmeister, the posterior margin of mesosternum is straight, while in *testaceus,* it is triangularly emarginated in the middle.

Body length: Male, 18.9-22.4 mm., female, 20.6-24.25 mm. Shining dark brown on dorsum and lighter on venter. Head light brown, but black vertex; antenna 213 to 219 segmented. Pronotum blackish brown with two crescent-shaped markings. Fore wing light brown, shining; hind wing yellowish brown, longitudinally folded at tip and extended beyond abdomen, cercus-like. Posterior margin of mesosternum triangularly emarginated. Hind leg strong, brownish in color; hind femur with six pairs of strong spines and also three pairs of spurs. Tarsi three-segmented, the middle segment smaller, the basal segment long and spiny, with a pair of spurs at tip, the inner spur longer than the outer, the latter almost as long as the middle tarsal segment. Ovipositor brownish in color, slightly curved; cerci brown.

C. Bionomics:

According to Chu (1951), *Gryllus testaceus* Walker has only one generation each year, and passes winter as eggs. The eggs start to hatch at the end of April. However, hatching will be delayed to the end of May when eggs are laid in shaded places. The nymphal stage has 6 instars and takes 20-25 days to become adult. In the beginning of October, after mating, the female lays eggs in soil and the insect passes winter in the egg stage. Adults die in the middle or the end of October, when the weather becomes cold.

Under natural conditions, the adults emerge in the latter part of May and lay eggs in the middle of October. One to eight days, average 3.7 days (average of 34 individuals) after laying eggs, the adults die.

There is no marked difference between male and female. The longevity of the adults is about 141-151 days, averaging 145.3 days (average of 10 individuals). In an experiment performed in 1950, it was found that the adults which emerged in the incubator (31°C) during the period from February 23rd to 25th also lived to the end of September. So the low temperature in October may be considered as the main cause of death of the adults.

D. Discussion:

Based on the above mentioned data that the field crickets pass winter as eggs and the adults appear in the middle of May and die in the beginning of October, we can conclude that the appearance of tens of thousands of adult crickets in March, on the snow over an area of about 2000 square meters, is definitely unnatural and it is disseminated by America planes.

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(14) Springtail (Isotoma negishina Börner)

A. Discovery:

Since February 29th, American planes have intruded successively into the districts of K'uan-Tien, Fu-Shun, Shenyang, Hsin-Ping and other places. Following the intrusions, large numbers of springtails were found in the above mentioned areas, for instance:

1. On March 4th, Huang Teh-Kung and Keng Ch'eng-Lin of the Fu-Shun Mining Administration discovered large numbers of springtails on the cement stadium of the race course 6 m. above the ground, on the cement roof of a building about 12 m. high and on the outer window sills.

2. On March 3rd, Liu Kuang-Yi, an inhabitant of the Old Station District of Shenyang found large numbers of springtails on the snow and ice in front his village. The area of dissemination was estimated to be about 1.5 kilometers in length and 0.5 kilometer in breadth. The greatest density was about 60-70 insects in a square meter.

3. On March 4th, Tang Yü-Ying, a worker of a post office of Ching-Yuan Hsien was examining the wire lines at Wan-Tien-Tze in the 7th District of Hsin-Ping Hsien. On his way home, he discovered large numbers of springtails on the surface of snow and ice in the fields, along the high way, and on and below the Sung-Mu Hills at Ta-Pien Kou Village of that district. The total area was estimated to be about 250 meters in length and 200 meters in breadth.

B. Identification:

Scientific name: *Isotoma negishina* Börner*.
Order Collembola, Family Isotomidae.

Identified by: Ma Shih-Chün, Associate Entomologist, Laboratory of Entomology, Academia Sinica.

Body length about 2 mm. The body is of a dark violet colour; legs and furcula pale whitish. Antennae langer than head (as 5.6:4) with segments in relative lengths nearly as 13:20:19:28. Sensory organ of the third antennal segment composed of 2 slightly curving rods accom-

* Another species of springtail disseminated by American planes has been identified as **Xenylla** sp.

panied by a shallow groove. Fourth antennal segment with one apical sensory bulb and 3-4 curved sensory hairs. Eyes 8 on each side. Postantennal organ broadly elliptical, about 2.5 times larger than the adjacent eye. Unguis rather straight, with a conspicuous inner tooth. Ratio of each body segment as (2.7:2.6) : (1.4:2.1:2.8:2.5:1.4:1.0). Anal and genital segments distinct. Furca on 5th abdominal segment, extending beyond ventral tube. Manubrium with many short hairs dorsally and ventrally. Dentes two to two and one third times as long as manubrium, slender, gradually convergent, crenulate dorsally. The crenulations disappeared at a point about 1.5 times the length of the mucro from the tip. Mucro shorter than hind unguiculus, quadridentate, apical tooth the longest, the anteapical one shorter. Third and fourth teeth usually opposite to each other. Rami of tenaculum quadridentate; corpus with 8 to 10 ventral setae.

C. Bionomics:

Isotoma negishina Börner is widely distributed. They have been recorded in Europe, Asia and Japan, but not in China.

The adults may be found in any season of the year, but more abundant between November and February. They inhabit mainly in the low and marshy ground, in the forests, and along rivers and lakes. Occasionally, they may be also found in decaying wood or putrifying organic matter and its neighboring soil. They are frequently found together with *Isotoma violacea* Tullhery. They keep themselves away from strong light but are attracted by darkness and moisture. They cannot resist dryness, but can withstand cold, and may be found on the ice or snow along rivers or in low land in winter. Experimentally they cannot survive at a humidity below 60%.

D. Discussion:

Following the intrusion by American planes into Fu-Shun, Shenyang, Hsin-Ping etc., large numbers of springtails were found, along the course of their flight, in localities where such insects should not occur. For instance in Fu-Shun they were found 6 m. above the ground on the stadium in the race course, on the cement roof of a 12 m. high building, and on the outer window sills of the houses. From literature on the ecology and habits of this and other allied species it can be concluded that under natural conditions the finding of large number of springtails in the above mentioned localities is definitely impossible. Furthermore, in Korea, many springtails have actually fallen on to the bodies of the soldiers. It clearly indicates that the appearance of springtails was resulted from the activities of the American planes.

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(15) Wolf Spider (Tarentula sp.)

A. Discovery:

Since February 29th, 1952, after the American planes repeatedly intruded into An-Tung, K'uan-Tien, Pen-Hsi and Tsing-Tao, large quantities of spiders were found suddenly in these areas, for example:

1. On March 3rd, Wang Yü-Sheng of Military Health Office, An-Tung City, found large numbers of spiders on snow around the patriot memorial tower at the Wrestling Ground in Chen-Chiang-Shan Park. They were scattered over an area of approximately 5000 sq. m. with a maximum density of more than twenty spiders per sq. m.

2. On March 4th, Chao Kwang-Hsin of Lao-Kuan Village, Ta-Yü-Ku, Pen-Hsi, found large numbers of spiders, flies and mosquitoes on snow and ice at the west bank of the river. Meteorological records of that day showed that the maximum temperature was -2°C, and the minimum was -19°C, with an average of -9.9°C.

3. On March 12th, Han Yung-Pin, a grocer salesman at K'uan-Tien saw a germ bomb dropping from an American plane, and then large numbers of spiders and anthomyiid flies were discovered in the nearby areas of Lou-ho-t'ao, outside the east gate of the city, on 13th, 14th and 15th.

B. Identification:

Scientific name: *Tarentula* sp.
Order Araneida, Family Lycosidae.

Identified by: Wang Feng-chen, Professor, Tientsin Army Medical College.

The genus *Tarentula* is widely distributed including China.* Owing to the fact that all the spiders examined were immature, it was not possible to identify to species.**

It is greyish brown in color. Cephalothorax with two broad, black longitudinal stripes on the back and a discontinuous black longitudinal line in the middle. Eyes arranged in three rows of 4:2:2. Lower margin of chelicera with two condyles. Legs brown with irregular black markings; three tarsal claws, the third one with a few teeth. Back of abdomen also with two longitudinal stripes but being narrow and zigzag in form, not so prominent as those of cephalothorax. Also pale shaped patterns between these two stripes.

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* The recorded species of the genus **Tarentula** in China are as follows:

1. *Tarentula aculeata,* Clerck—Hsin-chiang
2. " *carinata* Olivier—Kan-su
3. " *clarki* Hogg—Kan-su
4. " *ephippium* Hahn—Kan-su, Hsin-chiang
5. " *erudita* Simon—Peking
6. " *hsinglungshanensis* Saito—Jeh-ho
7. " *ordosa* Hogg—Kan-su
8. " *parricida* Karsch—Peking
9. " *pulverulenta* Clerck—Kan-su
10. " *pseudoannulata* Roesenberg und Strand—Su-chou,

Nanking, Szechwan

11.	„	*schmidti* Hahn—Kan-su
12.	„	sp. aff. *trabalis* Clerck—Kan-su
13.	„	*swatowensis* Strand—Shan-tou (Swatou)

**Lycosa sp. was also found among the spiders dropped by the American planes.

C. Bionomics:

This group of spiders generally lay eggs in May and June, or September and October. Young spiders can migrate to other places by floating in the air with the aid of its own gossomer. In winter, they usually hide themselves under fallen leaves, grass, stones, or in pits, although on sunny days, some might come out occasionally.

D. Discussion.

As mentioned above, under natural conditions spiders of this group usually hide themselves under various shelters in cold season, and definitely would not come out in large numbers. In this case, however, the spiders were found in large numbers on snow or on ice at a temperature below zero degree centigrade in Antung and K'uan-Tien, following the intrusions of American planes. It is therefore concluded that they were dropped by the American planes.

Bacteriological examinations showed that these disseminated spiders were contaminated with *Bacillus anthracis* and *Pasteurella multocida.*

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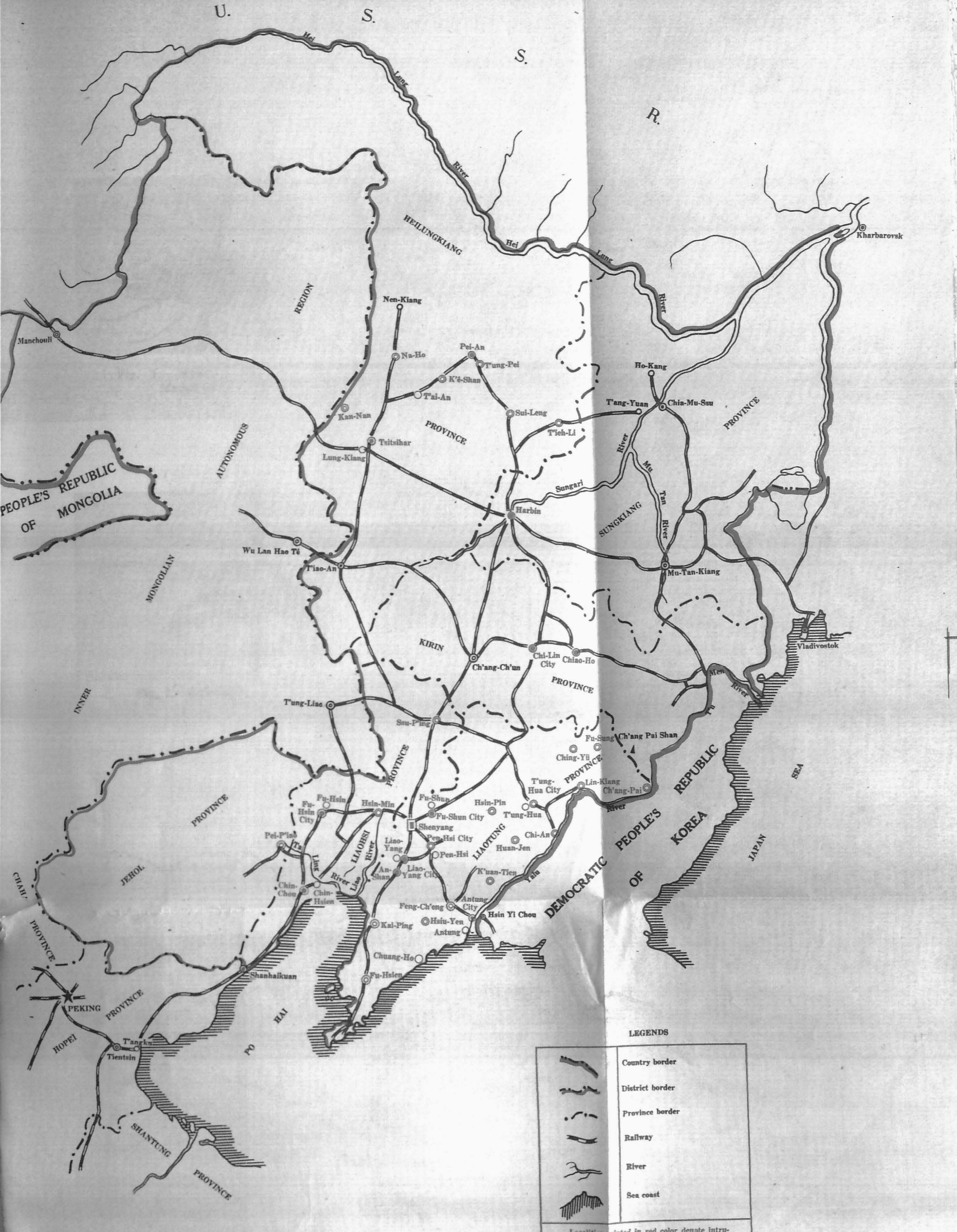


Map Showing Localities into Which American Planes Intruded and Disseminated Insects and Other Objects from February 29 to March 21, 1952

NOTE: Kan-Nan Hsien in Heilungkiang Province was invaded by an American plane in the night of April 4, 1952. Being a striking incident, it is included in the map.

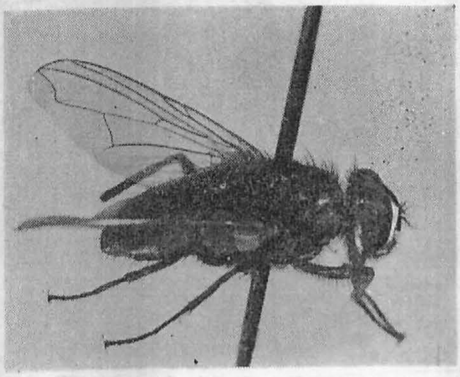


Fig. 1. *Musca vicina* Macquart.

Fig. 2. *Muscina stabulans* Fallen.

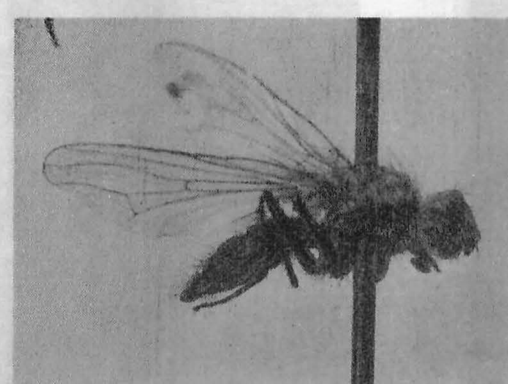


Fig. 3. *Hylemyia* sp.

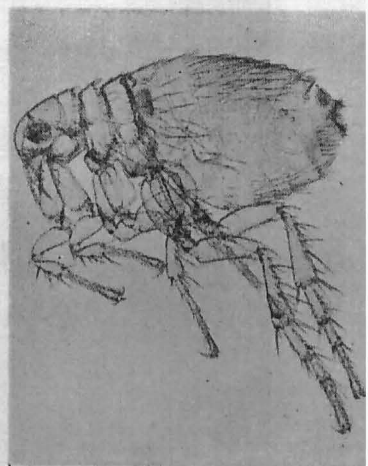


Fig. 4. *Pulex irritans* Linn.

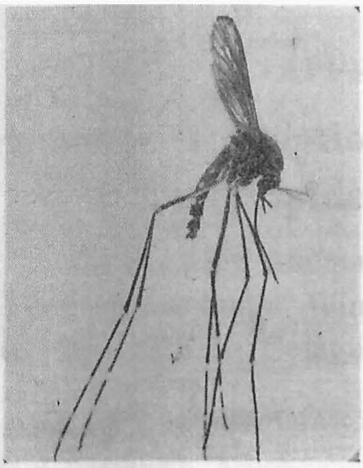


Fig. 5. *Aedes koreicus* Edwards.

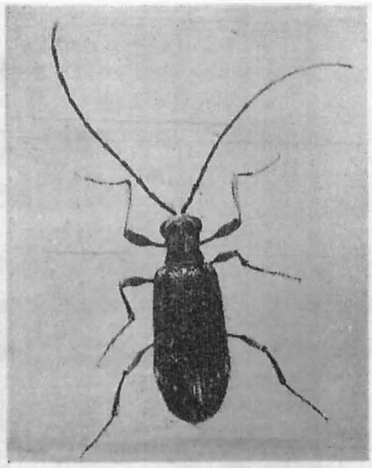


Fig. 6. *Ptinus fur* Linn.

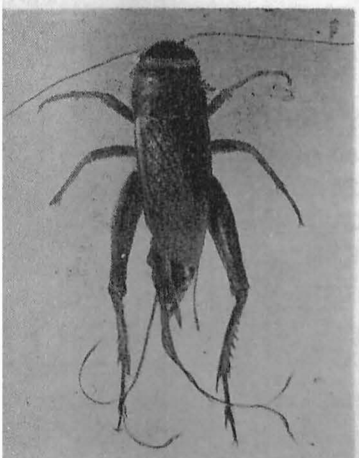


Fig. 7. *Gryllus testaceus* Walker.

Fig. 8. *Tarentula* sp.

APPENDIX H

Summary Tabulation of Species of Insects and Spiders Indentified

With Graphs Showing Anomalies in the Appearances of Unusual Insect Populations and of Winter Temperatures of Shenyang and Harbin, 1951-1952 in Comparison with Figures for 1950-1951

SUMMARY TABULATION

DIPTERA, Muscidae, house-fly

Musca vicina

Gen. descr.: a "house-fly" closely related to the occidental species *domestica*.

Habits: frequents decaying organic material and human food and dwellings.

Seasonal abnormality of appearance: normally appears beginning of May but much more abundant in June.

Here found in abundance mid-March. Inc. NE China (No napalm).

Anomaly, about 8 weeks.

Swarm density: no data.

Bact. finding: anthrax.

Remarks: widely distributed, common in Hawaii as well as in East continental Asia.

Identified by Ch'in Yao-ting & Fêng Lan-Pin.

DIPTERA, Muscidae, Non-biting stable-fly

Muscina stabulans

Gen. descr.: like a big occidental housefly.

Habits: larva phyto-saprophagous.

Seasonal abnormality of appearance: 4 weeks, normally appears in April.

Swarm density: no data.

Bact. finding: typhoid.

Remarks: has appeared mostly in association with masses of *Lucilia*, always the adults.

Identified by Ch'en Shih-Hsiang (Sicien H. Chen) & Lu Pao-Lin.

DIPTERA, Anthomyiidae, anthomyiid fly

Hylemyia sp.

Gen. descr.: black and about the same size as ordinary occidental houseflies.

Habits: phytophagous, saprophagous, etc., larvae of many species attack roots and stems, e.g. onion bulbs; adults frequent flowers.

Seasonal abnormality of appearance: species of the genus normally appear in May, found in abundance as early as end of Jan. and ready to lay eggs. Inc. NE China (no napalm). Anomaly 14 weeks.

Swarm density: 5—100/sq.m.

Bact. findings: cholera, typhoid, paratyphoid, dysentery in Korea; anthrax in China.

Remarks: of the genus *Hylemyia* some 600 species are known, 15 have been recorded from China (incl. Tibet & Manchuria), of which 4 are common in NE China. These are *floralis, platura, antiqua,* and *pilipyga.* Species *floralis* appears only in Aug. or Sept. Now the species here identified is *not* the same as any one of these uncommon or common species hitherto recorded.

No previous suggestions of possible occurrences as swarms on snow. Meteorologically winter was normal in NE China.

Identified by Ch'en Shih-Hsiang & Lu Pao-Lin.

DIPTERA, Calliphoridae, carrion-fly

Lucilia sericata

Gen. descr.: "blue-bottles", body of metallic colour variable from blue to green.

Habits: larvae feed on decaying animal matter.

Seasonal abnormality of appearance: normally appears in May, found in abundance March. Incl NE China (no napalm). Anomaly: 8 weeks.

Swarm density: no data.

Bact. findings: no data.

Remarks: has appeared mostly in association with masses of *Muscina,* always the adults.

Identified by Fêng Lan-Chou & Chao Chen-Shêng.

DIPTERA, Helomyzidae, sun-fly

Helomyza modesta

Gen. descr.: like *Hylemyia* but smaller.

Habits: similar to *Hylemyia.* No detailed work to have been done on this insect or its ecology.

Seasonal abnormality of appearance: normally appears end of April, found in abundance mid-March. Incl NE China (no napalm). Anomaly, 6 weeks.

Swarm density: no data.

Bact. findings: paratyphoid.

Remarks: Only one species previously recorded from China, namely, *H. engeli.*

Identified by Ch'en Shih-Hsiang and Lu Pao-Lin.

DIPTERA, Chironomidae, midge

Orthocladius sp.

Gen. descr.: small mosquito-like insects.

Habits: larvae generally aquatic; details unknown for this species.

Seasonal abnormality of appearance: none, can appear in March.

Swarm density: 100/sq.m.; it has been seen "falling down in black masses".

Bact. findings: typhoid.

Remarks: has usually appeared in association with *Hylemyia* and other flies.

The genus is a large one, but the species here identified is not one which had hitherto been recorded from China.

Identified by Liu Ch'ung-Lo. The original identification *Chironomus* was wrong.

DIPTERA, Culicidae, mosquito

Aedes koreicus

Gen. descr.: medium size.

Habits: not definitely proved that it transmits acute encephalitis; the suspicion is stronger for *Aedes chemulpoensis.*

Seasonal abnormality of appearance: normally appears end of May, found middle March: Incl. NE China (no napalm). Anomaly 10 weeks.

Swarm density: up to 70/sq.m.

Bact. findings: none.

Remarks: none.

Identified by Ch'in Yao-T'ing & Chang Tsung-Pao.

Culex pipiens var. *pallens*

Seasonal abnormality: same as for *Aedes,* anomaly of some 10 weeks.

Bact. findings: none.

Identified by Ch'in Yao-Ting.

SIPHONAPTERA, Pulicidae, flea

Pulex irritans

Gen. descr.: usual form and habit.
Seasonal abnormality: none.
Swarm density: as many as 7000/sq.m.
Bact. findings: plague (in Korea).
Identified by Fêng Lan-Chou & Chao Chen-Shêng.

ORTHOPTERA, Locustidae, locust

Locusta migratoria

Gen. descr.: common locust.
Seasonal abnormality of appearance: normally May and June, found in abundance March. Anomaly about 8 weeks.
Swarm density: no data.
Bact. findings: none.
Remarks: associated with *Lucilia* and *Muscina.*
Identified by Ch'en Shih-Hsiang and Lu Pao-Lin.

ORTHOPTERA, Tettigidae, grasshopper

Acrydium sp.

Gen. descr.: sometimes called grouse locust.
Seasonal abnormality of appearance: Normally appears in April. Anomaly about 4 weeks.
Swarm density: no data.
Bact. findings: none.
Identified by Ch'in Yao-Ting.

ORTHOPTERA, Gryllidae, field-cricket

Gryllus testaceus

Gen. descr.: the largest of the insects involved, about an inch long.
Habits: omnivorous, polyphagous.
Seasonal abnormality of appearance: very marked indeed, normal appearance of adults end of May, found in abundance mid-March, when usually there is no stage present other than that of the eggs. Incl. NE China (no napalm). Anomaly 10—14 weeks, allowing for Manchurian climate.
Swarm density: 10-20/sq.m.
Bact. findings: none.
Identified by Chu Hung-Fu.

COLLEMBOLA, Isotomidae, spring-tail, snow-flea

Isotoma negishina

Gen. descr.: primitive wingless insects frequenting damp places, water, snow (very resistant to cold), only 2 mm. long.

Habits: do not usually come in contact with man.

Seasonal abnormality of appearance: none, but the places in which they appeared, house verandahs, seats of a high stadium, hats and clothes of volunteers, very peculiar.

Swarm density: no figures, but it should be noted that it must have been very considerable, since such minute insects would have had to have been present in very great numbers to have attracted any attention at all.

Bact. findings: Rickettsia not further identified, dysentery (Korea).

Remarks: Collembola are eaten by ducks. Could there have been some thought of infecting man with some pathogen by this indirect route?

It is to be noted that several times specimen tubes of Collembola came in which contained many fleas (*Pulex irritans*) mixed among them. This was an extraordinary association, and not realised by the people who sent them in. T'ang Fei-Fên, however, was not able to find *P. pestis* in these fleas.

Identified by Ma Shih-Chün.

ARACHNIDA, Lycosidae, spiders

Tarentula sp.

Lycosa sp.

Gen. descr.: both species brown, total size when appendages contracted, the size of a large pea.

Habits: predaceous.

Seasonal abnormality of appearance: normally found end of April, found in abundance (it should be emphasised that the numbers were greater than any other form except the anthomyiid flies) beginning of March or earlier.

Anomaly some 6 weeks at least.

Swarm density: 20/sq.m.

Bact. findings: *Pasteurella multocida* and anthrax.

Identified by Wang Fêng-Chen

ADDENDA

DIPTERA, Trichoceridae, crane-fly

Trichocera maculipennis

Gen. descr.: large mosquito-like insects.

Seasonal abnormality of appearance: none, can appear in April (Karandikar, 1931).

Swarm density: no data.

Bact. findings: neurotropic virus.

Remarks: this species was inculpated in the encephalitis case (App. FF, GG) but is not now thought to have been concerned.

Identified by Ch'en Shih-Hsiang & Lu Pao-Lin.

PLECOPTERA, Nemouridae, stone-fly

Nemoura sp.

Gen. descr.: primitive winged insects with flat transparent wings about twice as long as their bodies.

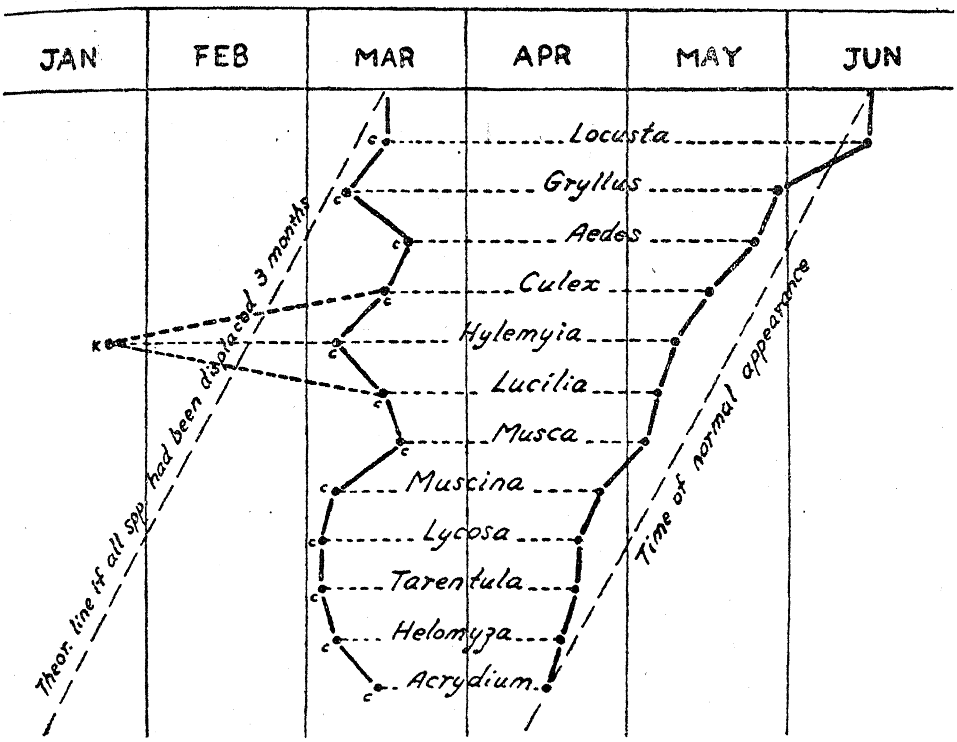
Habits: frequent water and stones on water edge; prefer to run rather than fly, and fly very slowly. Easily confused with "flying ants", by which name the peasants call them.

Seasonal abnormality: no data.

Swarm density: up to 100/sq.m.

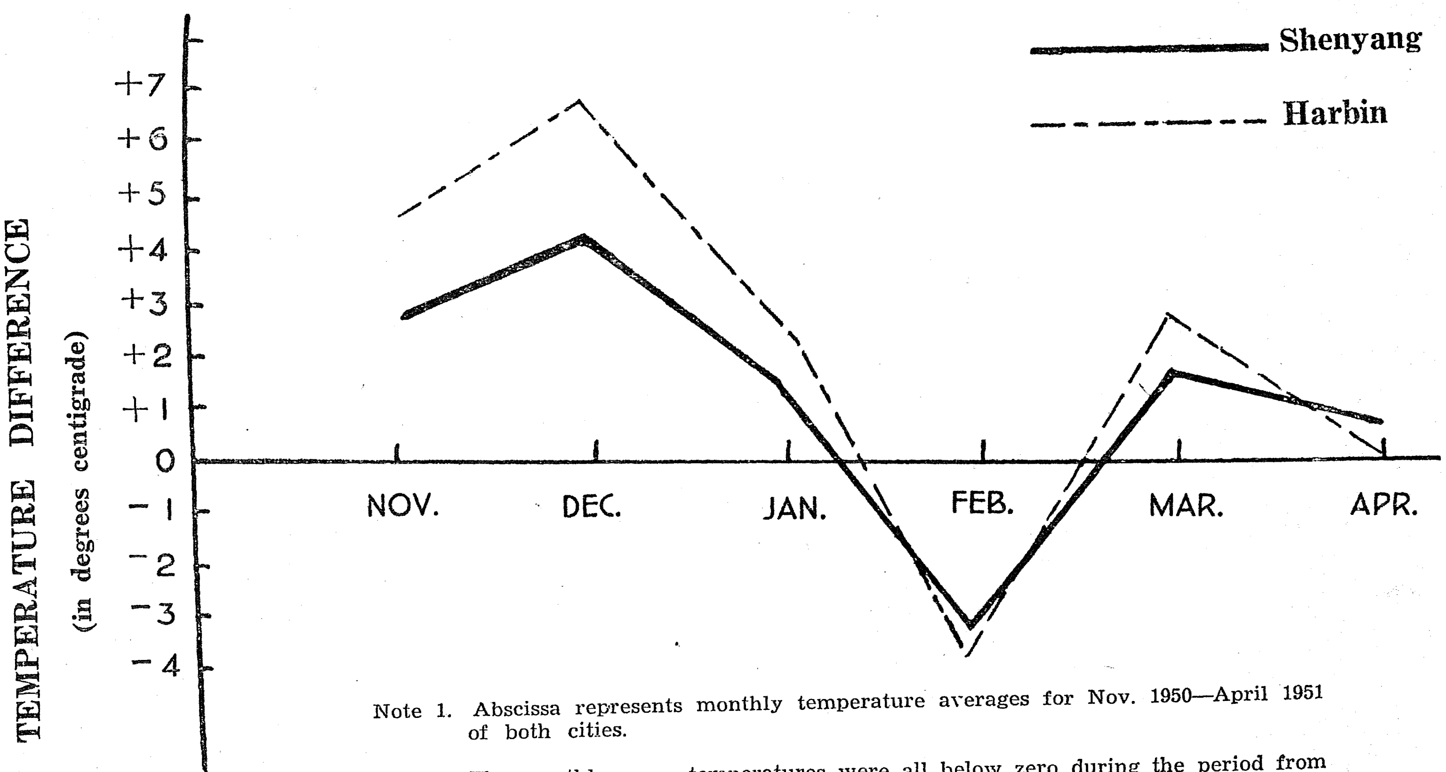
Bact. findings: none.

Identified by Hu Ching-Fu (Chengfu F. Wu)



K means insects appearing in Korea
C means insects appearing in China

Text Fig. 1. Graph showing the anomalies in the appearances of the unusual insect populations.



Note 1. Abscissa represents monthly temperature averages for Nov. 1950—April 1951 of both cities.

Note 2. The monthly mean temperatures were all below zero during the period from Nov. to March.

Note 3. The lowest mean temperature was -20.7°C

Text Fig. 2. Graph comparing the winter temperature of Shenyang and Harbin, 1951-1952 with figures for 1950-1951.

APPENDIX I

Questions Addressed to the Korean Minister of Health and Replies Received

A. QUESTIONS ADDRESSED TO THE KOREAN MINISTER OF HEALTH

Pyongyang, 30th July, 1952

It will easily be understood that the International Commission must, so far as possible, familiarise itself with the scientific data which were the basis for documents previously disseminated to the world (e.g. First Korean Report, SIA/1; Report of the Democratic Lawyers, SIA/4; Report of the Chinese Scientific Commission, NCNA/85; SIA/13, etc.). The Commission will naturally have to clarify in its report some of the most important phenomena described in these documents, and could not confine its work only to those cases which the Korean and Chinese colleagues have subjected to intensive study. The Commission therefore addresses the following questions to the Minister, with the hope that it may be possible to obtain the answers to them before its departure from Pyongyang. It does this with much hesitation, being unwilling to add to the heavy burden which the Minister already has upon his shoulders, but it must of necessity seek to validate and to explain or modify the statements contained in previous accounts circulating in the occidental world.

1) In the first and third reports above mentioned it was said that in 1952 ticks had been disseminated by planes, and that these *ticks* were of a species never previously reported from Korea. What was the zoological identification of these ticks? Latin name? Is it confirmed that the species had never previously been reported from Korea? Was it carrying encephalitis virus? Did it belong to a species known to do so? If not, what pathogenic organisms was it carrying? In what numbers were the specimens found?

2) In the first report it was said that certain bat parasites, *nycteribiid flies*, had been found in conditions such that dissemination from planes was suspected. Has this been confirmed? If so, what was the species? Latin Name? Has it been suggested that these insects

could carry any organism pathogenic to man, and if so, what? In what numbers and circumstances were these animals found?

3) In the reports there have been frequent mentions of *flies* infected with cholera and with typhoid (*S. typhosa*); were these always the anthomyiid flies of the genus *Hylemyia?*

4) The first report also speaks of tests showing that on one sample of *flies*, 2 out of 30 proved positive for cholera. In later investigations, were the percentages higher?

5) The first report spoke of *ants*. Is it still believed that they were disseminated by planes? What was their zoological identification (Latin name)? What disease organisms could they have been carrying? In what numbers were they found?

6) The first report spoke also of *mosquitoes*. Is it still believed that they were disseminated by planes? What was their zoological identification (Latin name)? In another report (SIA/2) they were identified as *Aedes koreicus;* is that confirmed? What pathogenic organisms would they be carrying? In what numbers were they found?

7) In the second report there is mention of *beetles* of the genus *Tenebrio*. Is it still believed that they were disseminated by planes? What was their zoological identification (Latin name)? What pathogenic organisms could they have carried? In what numbers were they found?

8) Is it now possible to say definitely, for these or for any other cases, that there is strong reason for thinking that insects have been disseminated by air activity which belonged to *genera or species hitherto unrecorded* from Korea?

9) The second report gave details of an outbreak of *plague* in the village of Bal-Nam-Ri near An-Ju, where out of a population of 600, there were 53 cases with 36 deaths. Could the Commission have further details on this incident?

10) It is said in the third report that *Collembola* were thrown down together with, or in the midst of, "white viscous masses". What was the nature of this sticky material? What further information is available about it?

11) It is also said in the third report that quantities of *"lyophilised proteinaceous material"* were found. What has been done to determine the nature of this substance, and what results were reached? Did it contain living bacteria? If so, what?

12) It is further said in the third report that insects were often *sprayed* directly from planes. Are any further evidences available for this? How was it supposed to occur?

13) What *types* of containers have been found dropped from planes? The Commission would like to have the opportunity of careful examination of as many as possible before leaving Korea.

14) The third report speaks of 804 *incidents* which took place between 28th January and 31st March. Between the 31st March and the middle of July there must doubtless have been many more. Could the Commission have more details on all these incidents, especially a summary breakdown by provinces, and especially by types of insects or other vectors employed, and pathogenic organisms thus carried or delivered direct?

15) Is it possible to confirm what was said in the third report on the appearance of cases of *anthrax* of domestic animals? To what extent was this disease of animals known or endemic in Korea previously? Is it still believed that vectors or mechanical carriers of anthrax bacilli have been disseminated by planes? If so, what were the carriers employed? Have there been any human cases?

16) In the third report there is mention of *fish* found on hill-sides and proved to be infected with dysentery (*S. dysenteriae*). Have these statements been confirmed? Were the fishes found in the neighbourhood of reservoirs, giving the impression that the aim of the planes was to contaminate the drinking-water supplies?

17) The third report also contains a description of *shells* fired in the neighbourhood of the front line by artillery, and containing insects. This description has been found more or less incredible in western countries. Perhaps by some mistake it had been intended to say shells containing bacteria, which would be much more possible. The Japanese proposed (and perhaps used) long ago shrapnel in which the metal fragments inside had been contaminated with a gelatinous covering containing *B. welchii* (gas gangrene bacillus).

The Commission begs the Minister to elucidate these points.

B. REPLIES RECEIVED TO THE ABOVE QUESTIONS

The Commission, in acknowledging with thanks the following replies communicated from the Minister of Health of Korea, records its understanding of the difficulties which prevented the answers being more elaborate in character, though by no means detracting from their interest. Comments added are enclosed in square brackets.

Peking, 21st August, 1952

1) *Ticks*

The word "tick" was a mistranslation. The animals in question should have been termed red mites.

They were identified as *Trombicula akamushi,* a mite belonging to the family Trombidiidae.

[This is the well-known mite which in Japan and China carries the pathogenic agent of tsutsugamushi fever, *Rickettsia orientalis.* This mite is related to the common *Microtrombidium aoutra* of Europe].

This mite was previously known in Korea. That the specimens found were carrying any pathogenic agent was not determined.

Nevertheless, it was still considered that the specimens had been disseminated by American planes. They had occurred in company with many other arthropods, among which flies and fleas were the most numerous. The incident of 28th January, when they were found, was one in which the density of the arthropods on the snow amounted to about 10/sq. yard.

2) *Bat Parasites*

It was to be considered confirmed that nycteribiid flies, parasites of bats, had been found in circumstances pointing to their dissemination by American planes. They were found among other insects on the snow in a miscellaneous delivery.

Owing to war-time difficulties it had not so far been possible to make an exact zoological identification.

Whether this species had previously been reported from Korea or not, could not be decided from the literature at present at the disposal of Korean entomologists.

It was still uncertain whether these nycteribiid flies had been carrying any pathogenic agent harmful to man or animals.

3) *Flies*

It was confirmed that certain batches of anthomyiid flies disseminated by American planes had been infected with cholera. Whether these had always been *Hylemyia,* spp., could not be definitely stated.

4) *Flies, Percentage Infected*

In general the percentage was not uniform. The figure of 2 positive out of 30 had only been one of the early cases.

Later batches showed higher percentages.

Often, however, only qualitative tests on massed specimens of the insects, had been done.

5) *Ants*

It was to be considered confirmed that these had been disseminated by American planes.

Zoological identification had not been made.

No pathogenic agents had been found in or on the ants.

6) *Mosquitoes*

It was to be considered confirmed that these had been disseminated by American planes.

The mosquitoes disseminated were *Anopheles* sp.; no pathogenic organisms have been found on or in their bodies; no report has been issued concerning *Aedes koreicus.*

7) *Beetles*

The report of the Koreans themselves (SIA/1) had made no mention of these, but nevertheless the information contained in SIA/4 was substantially correct. Beetles related to the mealworm (Tenebrionidae), had appeared, in circumstances which pointed to their dissemination by American planes. No pathogenic bacteria were found in or on these insects. Precise entomological identification was not done.

8) *Unrecorded species*

No reply received.

9) *Plague*

The only further information relevant was that the cases began three days after the discovery of the fleas.

It was to be noted that the first cases were bubonic in character, while later on pneumonic cases began to appear. The epidemic spread with great rapidity.

10) and 11) *Sticky masses of Proteinaceous Material, and Collembola.*

The protein material found was sticky and hygroscopic; according to some eye-witnesses, lumps of it looked like the half of a boiled egg without the yolk.

It was hygroscopic and absorbed water on the surface of the snow.

It contained mannitol-fermenting dysentery bacteria.

[These could be one or more of several kinds of *Shigella,* e.g. *flexneri* or *alkalescens.*]

The chemical composition of the masses showed them to be composed of proteoses, peptones and polypeptides. There could thus be little doubt that the material was a freeze-dried culture of bacteria in some medium such as bouillon, casein digest or the like. The relation with the Collembola, *Isotoma negishina,* found with this material, remained unclear.

12) *Spraying of Insects Direct from Planes*

This had been deduced from many examples of large numbers of insects on the snow, after the passage of American planes, unaccompanied by any containers. Frequently the insects were found just at dawn on the snow, after the previous passage of a plane before it was light.

Many eye-witnesses had actually seen insects falling from the air, and some of them actually fell upon their clothes and caps.

Frequently also American planes were seen to leave behind what looked like black round masses or to emit a black smoke from the tail. These diffused as they fell, and immediately afterwards large numbers of insects were found on the snow.

13) *Containers*

The Commission will [and did] see at Pyongyang examples of (a) the four-compartment bacterical bomb, (b) the card board cylinder equipped with parachute, and (c) fragments of green plastic artillery shells.

14) *Number of incidents*

The figure of 804 was a preliminary one. Since the time at which it was published, the number has risen very greatly.

15) *Anthrax*

It was to be considered confirmed that cases of animal anthrax had been observed and verified in the northern part of Korea. Human cases had not been reported yet.

16) *Fish*

Bacteria of the *Salmonella* group had indeed been found on fishes lying on the mountain-sides as also others of the *Shigella* group. They were discovered near drinking-water sources, and it was indeed probable that they had been intended for the contamination of the latter.

17) *Artillery Shells*

No reply, except that the Commission had been shown the fragments of the green plastic shell.

Shrapnel contaminated with gas-gangrene had not been encountered.

APPENDIX Ja

Report on Fungus-Laden Plant Materials Dispersed by U.S. Military Planes in Northeast China and in the Northern Part of Korea

(ISCC/7a)

I. SOYBEAN STALKS AND PODS HARBOURING A PURPLE SPOT FUNGUS DISSEMINATED BY U.S. MILITARY PLANES IN THE NORTHERN PART OF KOREA

At 1 p.m. on March 20, 1952, in Yeunpoong Li, Koan Myon, Chongju Goon, Pyongan Bukdo, Korea, Sun Chih-Chien, Deputy Political Instructor of a certain detachment of the Chinese People's Volunteer Forces in Korea, saw four American "Sabre" jet planes and a dark mass dropping. The mass broke up at the height of about 300 meters. Then soybean stalks and pods and some sort of tree leaves began to fall down. These scattered over an area about 200 meters in width and 500 meters in length, there being on the average 2 to 3 soybean stalks and pods, and 15 to 16 leaves per square meter.

A sample of soybean stalks and pods was sent to this laboratory (Peking College of Agriculture) for examination on April 10, 1952.

Macroscopic examination: There are black spots on the soybean pods. These spots are rather irregular, measuring 0.3-1 mm. in diameter.

Microscopic examination: A small piece of the spotted soybean pod was boiled in water for 1 minute. The tissue of the pod was so softened that the epidermal layer was easily peeled off. The epidermal layer from the spotted portion was fixed in lacto-phenol and observed under the microscope. Tufts of conidiophores were observed, but a few conidia were found (Fig. 1).

The conidiophores are grouped in tufts on a stroma. Stromata are blackish brown, 50-60 μ in diameter; conidiophores are olivaceous brown, paler toward the apex, erect, non-branched, 2-4 septate, slightly tapering upward, with prominent spore scars at the apex, 70-140 x 4.5-5.5 μ ; conidia are hyaline, acicular to cylindrical, septate, 72-180 x 3-4.5 μ; mycelium olive to olivaceous brown, paler toward the hyphal tip, septate, sometimes irregular, permeating throughout the epidermal cells even into cells of trichomes.

Isolations of the Fungus: On April 24, 1952, isolations were made by transferring some of the fungus material on potato dextrose agar medium. From these fungus materials colonies were produced which were whitish at first and olivaceous to dark brown with age. Typical conidia were not produced in culture. On potato dextrose agar medium with 10% peptone, the mycelium remained whitish despite aging.

Pathogenicity tests:

1) Inoculation of germinating soybean seeds: On May 12, 1952, well grown plate cultures of the isolate were prepared. On each plate, 4 disinfected soybean seeds were sown. Five days later, small dark spots appeared on the seed coat at the points where the seeds were in contact with the culture. Since the soybean seeds were germinating, the newly produced radicles were also badly attacked when they were in contact with the culture. Those radicles which were not in contact with the culture, however, remained healthy. Observations were made again on May 19, 1952. The seed coat turned dark brown while the cotyledons produced dark lesions. Repetitions of the experiments yielded the same results. Re-isolations recovered the same pathogen.

2) Inoculation of soybean seedlings with infested soil: On May 26, 1952, 4 flasks of pure culture of 10 days old were ground and mixed with 400 grams of sterilized sand. This served as inoculum and was divided into four equal parts. Each part was used to inoculate one pot of sterilized soil. Four pots of sterilized soil were thus infested while other two pots of sterilized soil were used as check. Soybean seeds free from any spots were disinfected with 1:1000 $HgCl_2$ solution for one minute and washed in sterile water four times. Four seeds were sown in each of the six prepared pots of soil. Records were taken on June 12, 1952. The results are shown in the following table:

Infection Rate of Soybean Seedling Grown in Soil
Infested with *Cercospora sojina* Hara

	Soil infested with the fungus				Sterilized soil without artificial infestation	
Pot No.	1	2	3	4	5	6
No. of seeds sown	4	4	4	4	4	4
No. of seeds germinated (seedlings)	2	3	3	3	2	4
No. of seedlings infected	2	3	3	3	0	0

The results revealed that all of the seedlings in the infested soil produced brown lesions at the base of hypocotyls, on the roots and on the cotyledons (Fig. 2). No such lesions were found on the seedlings grown in the control pots.

Identification of the pathogen: According to the morphological and pathological studies, this fungus is identified as *Cercospora sojina* Hara. This is a detrimental pathogen to soybean crop. The fungus overwinters on diseased soybean leaves, stems, pods and seeds, by means of which the fungus is distributed.

II. TREE LEAVES HARBOURING ANTHRACNOSE FUNGUS SCATTERED BY U.S. MILITARY PLANES IN NORTHERN PART OF KOREA

At 11 a.m. on February 28, 1952, a Chinese People's Volunteer, Wu Yao-chuen at Dai-Tek San, east of Kaesong, Korea, witnessed two U.S. planes dropping five big roundish objects from which large quantities of tree leaves were dispersed over an area of about one square kilometer altogether with an average about 1 to 3 leaves per square meter.

Macroscopic examination: The specimen was sent to this laboratory on April 10, 1952. The identity of the tree leaf could not be determined on account of its fragmentary condition. Nevertheless, it was certain that it was not cotton, apple or pear leaf. The color of the specimen was yellowish brown. The lower surface of the leaf was covered with black dots (Fig. 3). A specimen of another kind of tree leaf collected from the same place has been identified as *Quercus aliena* Bl. var. *rubripes* Nakai (App. Jb).

Isolation and culture of the plant pathogen: Small pieces of the specimen were cut and sterilized in $HgCl_2$ (1:1000 solution) for 3 minutes. After being rinsed in sterile water for three times, they were cultured on potato dextrose agar plates. Five days later, the fungus mycelium grew well from each piece of the leaf tissue. Acervuli appeared in some of the colonies and were found to produce conidia. Morphologically this fungus is typical of anthracnose fungi.

Pathogenicity tests:

1) Inoculation of cotton seedlings: On April 26, 1952, disinfected cotton seeds were germinated aseptically. The healthy young seedlings were put either on plates or in test tubes of potato agar medium on which the fungus was grown. Four days later, the hypocotyls as well as the roots of the cotton seedlings were badly attacked and produced reddish brown lesions. The cotyledons were also attacked, producing dark brown spots. The symptoms are close to those caused by the cotton anthracnose fungus. Re-isolations recovered the same organism.

On April 20, 1952, six pots of sterilized soil were used for the experiment. Four of them were inoculated with the fungal culture; the other two pots served as control. Three healthy cotton seedlings were planted in each of the six pots. Four days after planting, 9 plants out of 12 were badly diseased (Fig. 4, 5). Two more plants became diseased two weeks later. The plants in the two control pots remained healthy. Re-isolations recovered the same fungus.

2) Inoculation of cotton bolls: On July 18, 1952, five young bolls of cotton were inoculated with the fungus, while two other bolls of the same variety were used as controls. Before inoculation, the bolls were surface-disinfected with alcohol. Small quantities of spore suspension, about 0.1 cc. each, were injected into the bolls at several points. For the controls, only sterile water was injected. The inoculated bolls as well as the controls were maintained with a high humidity for three days.

On July 22, four days after inoculation, dark brown spots were found at points of injection, whereas no such spots were formed in the case of the controls. On August 9, the spots extended to 2 mm. in diameter and had pinkish sunken centers and purplish brown margins.

3) Inoculation of apples and pears: On April 26, 1952, apples and pears were disinfected with alcohol and then inoculated with the fungus culture in two ways: one by puncture and the other by surface contact. Three days after inoculation, brownish water-soaked spots were produced in the case of wound inoculation (Fig. 6). Since May 3, 1952, eight days after the inoculation, acervuli and perithecia of the fungus were successively produced. Re-isolations recovered the same fungus.

The infected apples and pears produced symptoms very close to those caused by anthracnose (bitter rot) of apple, namely brownish water-soaked spots with concentric zones. The acervuli with flesh-colored gelatinous mass of spores are characteristic of the anthracnose of cotton and the anthracnose of apple.

Inoculations made by contact of the apples and pears with the fungus mycelium were also successful, but the incubation period was longer (about two weeks).

4) Inoculation of apple and pear shoots: On July 18, 1952, inoculations of the fungus culture were made on the shoots of apple and pear plants. Three young shoots of apple and six young shoots of pear including three Oriental and three European varieties were inoculated with 0.1 cc. of spore suspension into the bark, and a young shoot of each was injected with sterile water as control. The inoculated shoots as well as the controls were maintained with a high humidity for 3 days. Twenty days after inoculation, cankers ranging from 0.4-0.8 cm. in diameter with lengthwise cracking were seen in all inoculated cases (Fig. 7), while the

controls remained normal, except for minute calluses caused by the needle wound.

Morphology of the fungus: Conidia were produced in dark-colored, setosed acervuli; setae are straight, single, brown to olive brown, septate, 45-60 x 3-4 micra; masses of conidia are pinkish in color and gelatinous in appearance. Conidia are oblong, slightly curved, hyaline, with one to two oil globules, 12-17.5 x 3.5-6.3 micra (Fig. 8, 9).

Conidia germinated readily in water drops. One or more septa were formed in each of the conidia during germination and from each cell protruded a germ tube, at the tip of which a dark brown appressorium was formed (Fig. 10).

Perithecia were produced in abundance, dark brown in color, subspherical, more or less grouped and measured 80-250 micra in diameter. Asci are subclavate, hyaline, containing 8 spores usually in two series, 44-72 x 8-12 micra. Ascospores are hyaline, slightly allantoid, unicellular, with a single oil globule, 12-22 x 4-6 micra (Fig. 11).

Identification of the pathogenic fungus: According to morphological and pathological studies, this fungus is definitely a species of *Glomerella* sp. with its imperfect stage *Colletotrichum.* Its host range is remarkably wide, attacking pear, apple and cotton plants. This fungus differs from the anthracnose fungus of apple (*Glomerella cingulata* (Stoneman) S. & S.) and the anthracnose fungus of cotton (*Glomerella gossypii* (South.) Edg.) both in morphology and in host range.

III. PEACH LEAVES HARBOURING PEAR AND APPLE RING SPOT FUNGUS DISSEMINATED BY A U.S. MILITARY PLANE IN NORTHEAST CHINA

At 11 a.m., July 10, 1952, in Chuan-Yen-Kou, Sheng-Ch'an Village, Hsiu-Yen Hsien, Ma Hsiu-Lin, a farmer, witnessed an American plane flying in a northeastern direction. Thereafter, he found large quantities of leaves dispersed from the air into a field covering an area of about 10,000 square meters with an average of one leaf per three square meters. A sample was collected and sent to this laboratory for examination on July 26, 1952.

Identification of the host plant: On examination of the leaves disseminated by the U.S. plane, the plant of the leaves is identified as *Prunus persica* Sieb. et Zucc. (Fig. 12) by Prof. Liou Tchen-Ngo. (Liu Chen-O), Dr. Ling Yong and Mr. Kuang Ko-Zen.

Macroscopic examination: The leaves are dark brown in color with a few discolored spots. When they were placed in a moist chamber, black dots developed in abundance after six days. These are fruiting bodies of a kind of fungi.

Isolation of the plant pathogen: Isolations were made by tissue cultures on August 1, 1952. Uniform fungal colonies were produced from each piece of the plant tissue 48 hrs. after planting on potato dextrose agar plates. Mycelium of the organism was whitish at first becoming grayish with a blue tint later (Fig. 13). Pycnidia were produced in abundance in this medium eight days after planting.

Pathogenicity tests:

1) Inoculation of apples and pears: On August 4, 1952, apples and pears were surface-disinfected with alcohol and then inoculated with fungal culture in the following ways:

Method 1. Shallow cuts about 3 mm. in diam. were made on the skin of the fruit and into each cut a bit of fungal culture was inoculated.

Method 2. Minute punctures were made on the fruits and discs of agar bearing the fungal culture were applied to the wounds.

Method 3. The same as method 2, but no puncture was made.

In the case of pear, only methods 2 and 3 were employed. The size of the lesions produced 48 hrs. after inoculation were recorded and the results are shown in the following table:

	Method of inoculation	Size of lesions 48 hrs. after inoculation (average of 6 replications)	
		Inoculated	Control
Apple	1	23 × 25 mm.	0
	2	28 × 29 mm.	0
	3	7 × 5 mm.	0
Pear	2	67 × 67 mm.	0
	3	45 × 50 mm.	0

As the organism is highly infectious, all the above methods of inoculation were found successful. Brownish circular spots were produced at first and increased in size rapidly (Fig. 14). Distinct zonations were observed in some of the lesions (Fig. 15). The infection extended into the interior of the fruits causing soft rot of the tissue. Four days after inoculation, the pears collapsed completely (Fig. 16). In the case of apples eight days were required to attain the same condition. Re-isolations recovered the same organism in all cases.

2) Inoculation of the apple twigs. On August 4, 1952, four one year old apple plants were used for the inoculation test. Two of the plants were kept as controls, and the other two were inoculated as follows: the

twigs were first disinfected with alcohol, minute punctures were then made on the tender parts of twigs and petioles. Agar discs bearing the fungal culture were applied to the wounds as inocula. After inoculation the young twigs were wrapped round with cellophane paper. From time to time sterile water was injected into the cellophane chamber in order to maintain the humid condition. The control plants were kept in the same manner as the above except no fungal culture was applied to the wound. Two inoculated plants produced cankers and die back 48 hrs. and 96 hrs. after inoculation respectively (Fig. 17), while the controls remained healthy throughout.

The above inoculation tests demonstrated that: (1) the organism is highly infectious to both apples and pears, as lesions and rots developed very rapidly on the fruits; (2) infection on the fruits can also take place through the intact skin; (3) cankers and die back symptoms are produced when inoculations are made on the young twigs of the apple plants.

Morphology of the fungus: Pycnidia were produced in abundance, at the central portion of the lesions of the apple six days after inoculation. They are scattered, erumpent, ostiolate, ovoid to broadly elliptic, dark brown in color, measuring 260-420 x 200-260 micra. Pycnidospores are hyaline, non-septate, cylindrical to fusoid, 20-25 x 4.0-6.5 micra (Fig. 18). Mycelium is whitish at first, becoming greyish with a blue tint.

Pycnidia also were produced in abundance in potato dextrose agar medium.

Identification of the pathogenic fungus: Based on morphological and pathological studies, this fungus is identified as *Macrophoma kuwatsukai* Hara. This organism is highly infectious causing severe rots (ring spot) on both apples and pears. It also causes canker and twig blight on apple tree. Obviously this fungus is a dangerous parasite for the orchards.

Since an American plane disseminated large quantities of peach leaves harbouring this dangerous parasite, it is evident that the U.S. government intended to use this organism to cause damage to the crops of Northeast China.

IV. FUNGUS-LADEN CORN (MAIZE) KERNELS FOUND IN A LOCALITY OF NORTHEAST CHINA WHERE INSECTS AND OTHER OBJECTS WERE DISPERSED BY U.S. MILITARY PLANES

On March 19, 1952, Mr. Fu Min (age 37) a farmer of Sunchiapaotze, Wulungpei, Antung district, discovered a certain quantity of corn kernels scattered beside a river. Since the major part of the dropped corn kernels

had been burnt by the peasants immediately after their discovery, only a small sample was sent to this laboratory for examination.

Macroscopical examination of the corn kernels: There are black pustules on the top of some of the corn kernels (Fig. 19). A dark powdery substance was found in such pustules.

Microscopical examination of the fungus: It is found that the black pustules are sori of a certain kind of smut. Sori are dark brown; spore balls are subglobose, rather permanently united, 14-30 μ in diameter, each composed of 3 to 20 spores; spores are dark brown, usually hemispherical, sometimes more or less irregular, 8-14 μ in diameter; contiguous surfaces of the spore are flat and smooth; free surfaces of the spore are round and coarsely verrucose.

Germination test: The spores retain a high capacity of germination. They are readily germinated after 24 hours incubation at room temperature in drops of tap water (Fig. 20). During the germination, each chlamydospore of the spore ball produces a promycelium, from the tip of which a sporidium buds out.

Identification of the fungus: According to morphological studies, this fungus is identified as *Thecaphora* sp., a smut. *Thecaphora* sp. on corn kernels is hitherto unknown in China. A species of the genus, *Thecaphora deformans* Tul. is known to be detrimental to legumes in America and Europe.

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Peking College of Agriculture.

Date of Report: Aug. 20, 1952

I. **Purple spot of soybean**—*Cercospora sojina* **Hara Figs. 1 to 2.**

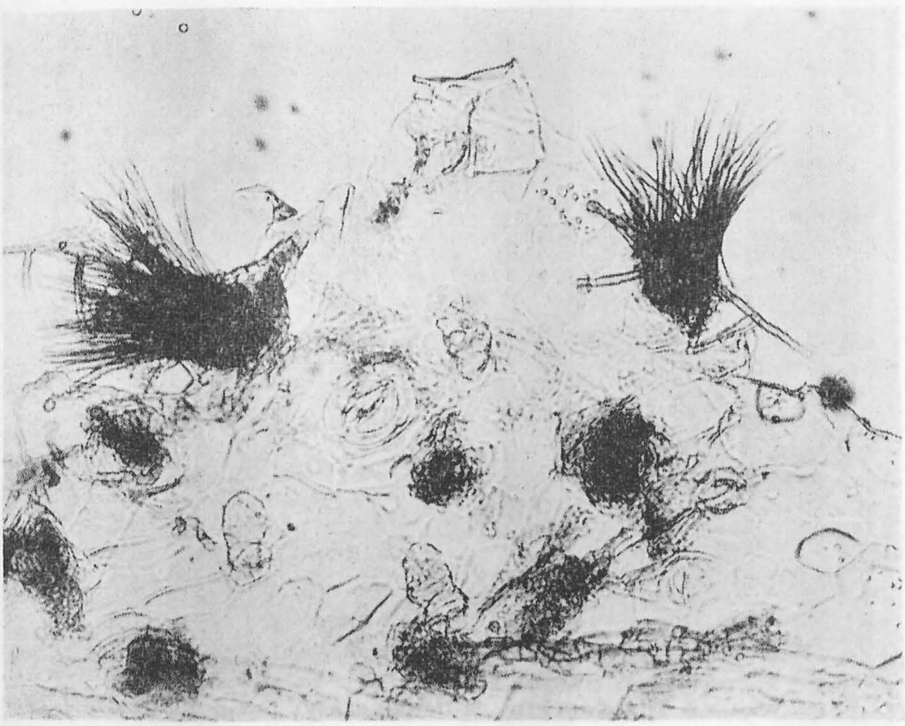

Fig. 1. Epidermal layer of soybean pod showing two tufts of conidiophores of *Cercospora sojina* Hara (210X).

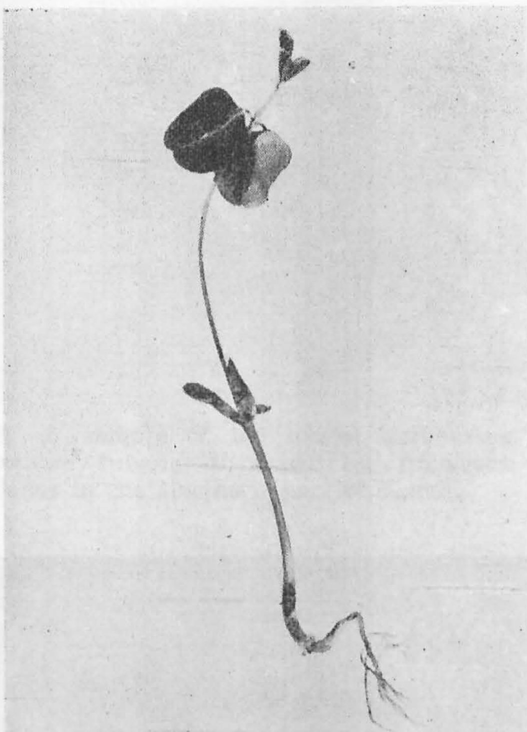

Fig. 2. A soybean seedling grown in soil inoculated with the pure culture of *Cercospora sojina,* isolated from the soybean pod dropped by American planes in the northern part of Korea, showing dark lesions at the base of the hypocotyl and on the root and cotyledons.

II. Anthracnose of apple, pear and cotton—*Glomerella* sp. Figs. 3 to 11.

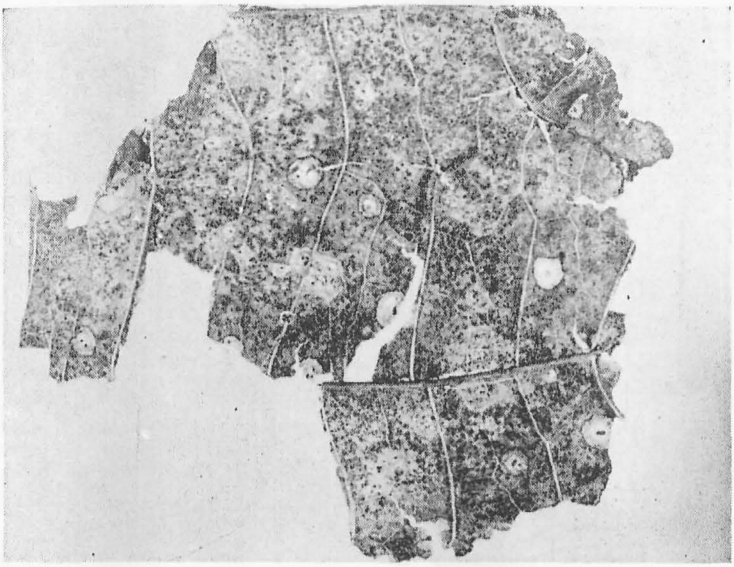

Fig. 3. A sample of the leaves harbouring anthracnose fungus dispersed by American planes in the Northern part of Korea.

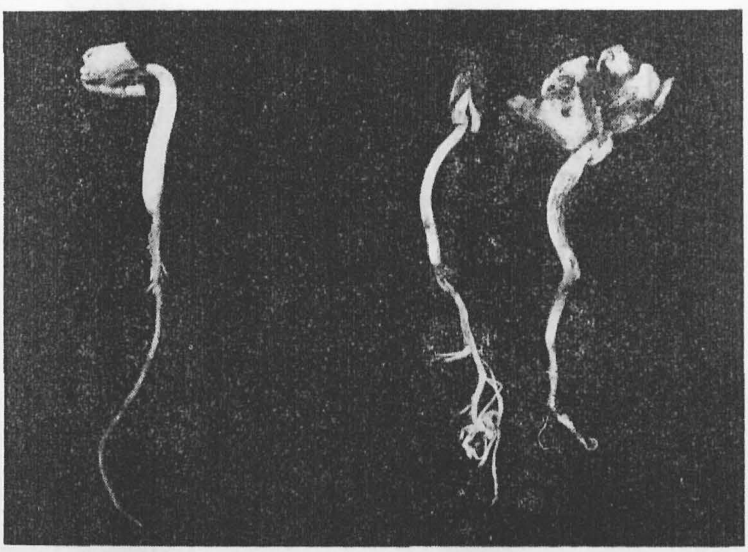

Fig. 4. Cotton seedlings after inoculation with the culture of *Glomerella* sp., showing lesions on the hypocotyls, roots and cotyledons. Left: soil inoculation. Right: plate inoculation.

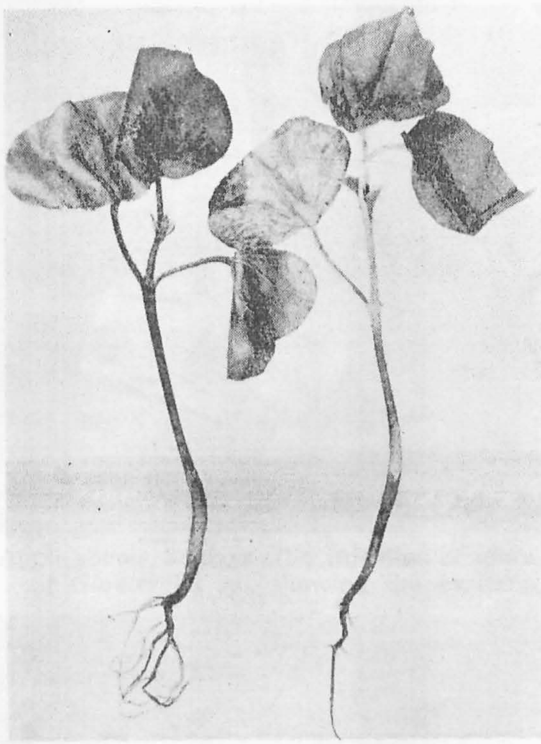

Fig. 5. Cotton seedlings grown in soil inoculated with cultures of *Glomerella* sp., showing the lesions on the stems and roots.

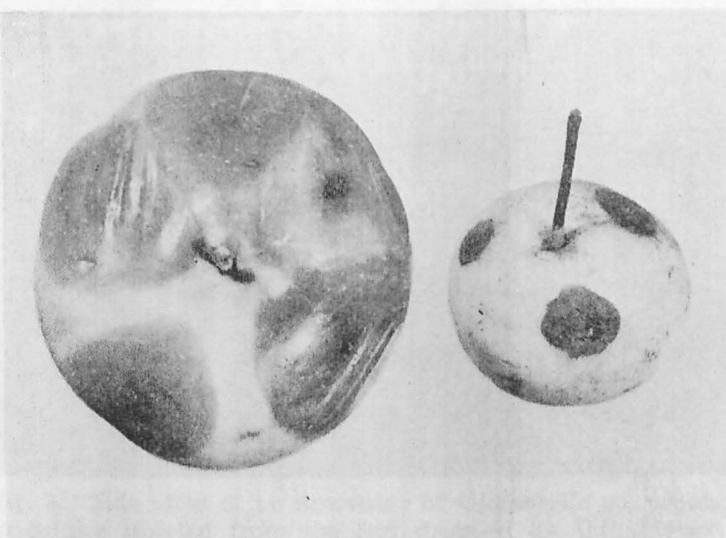

Fig. 6. Apple and pear, 5 days after inoculation with the culture of *Glomerella* sp., showing circular brown spots with concentric acervuli at centers. Left: apple. Right: pear.

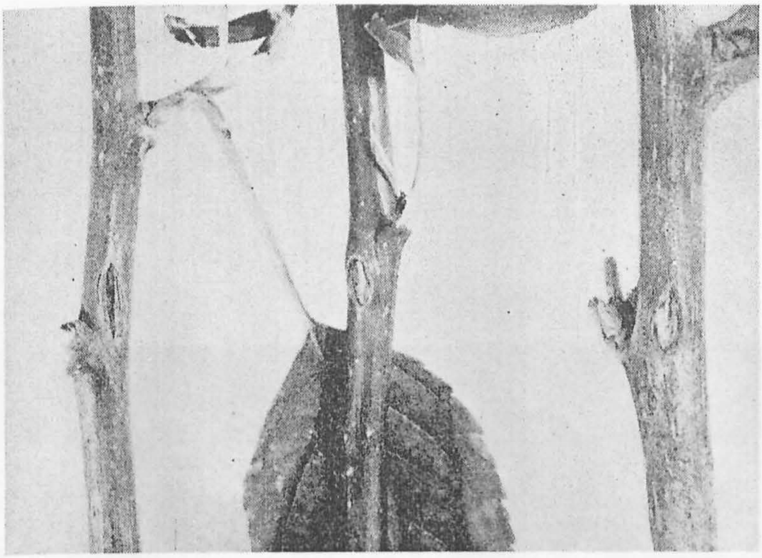

Fig. 7. Apple shoots, 28 days after injection of spore suspension of *Glomerella* sp., showing the cankers.

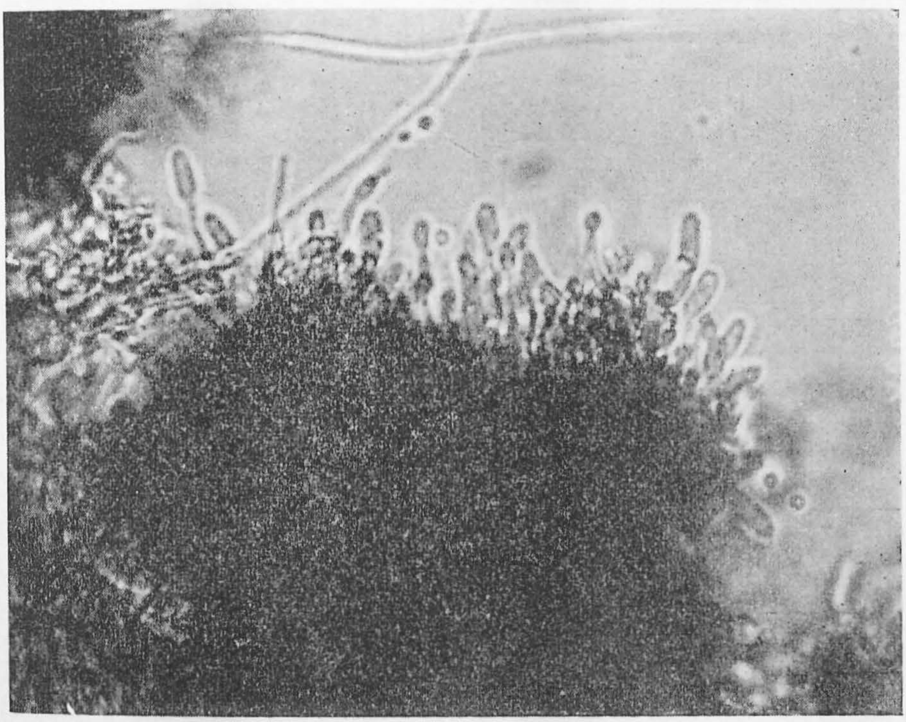

Fig. 8. Side view of an acervulus of *Glomerella* sp. produced in culture isolated from the leaf dropped by U.S. planes in the northern part of Korea, showing short conidiophores and single-celled conidia (x 640).

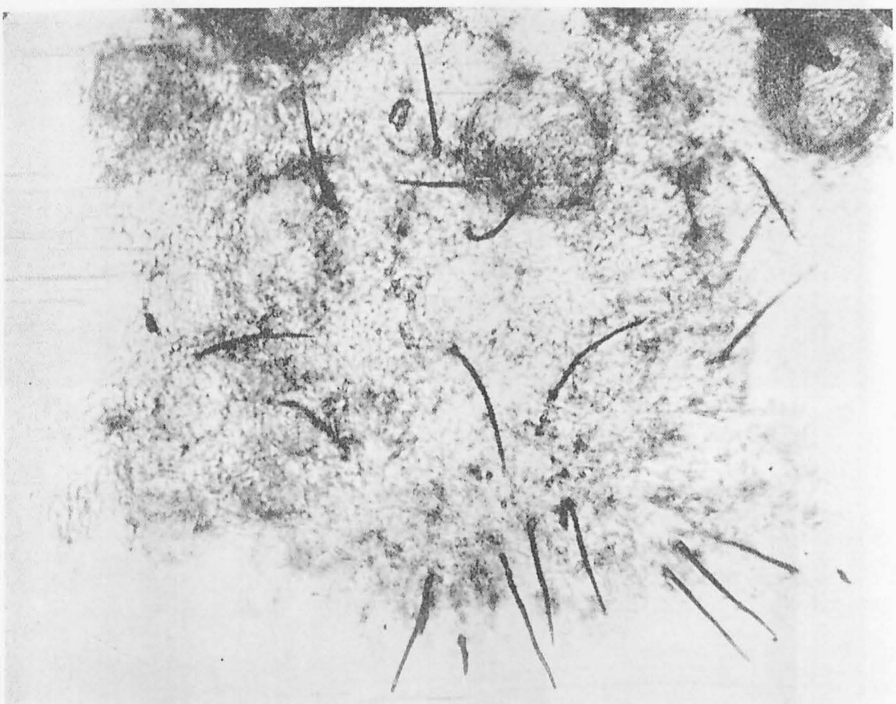

Fig. 9. Top view of acervuli of *Glomerella* sp. grown in culture showing the prominent setae (x 220).

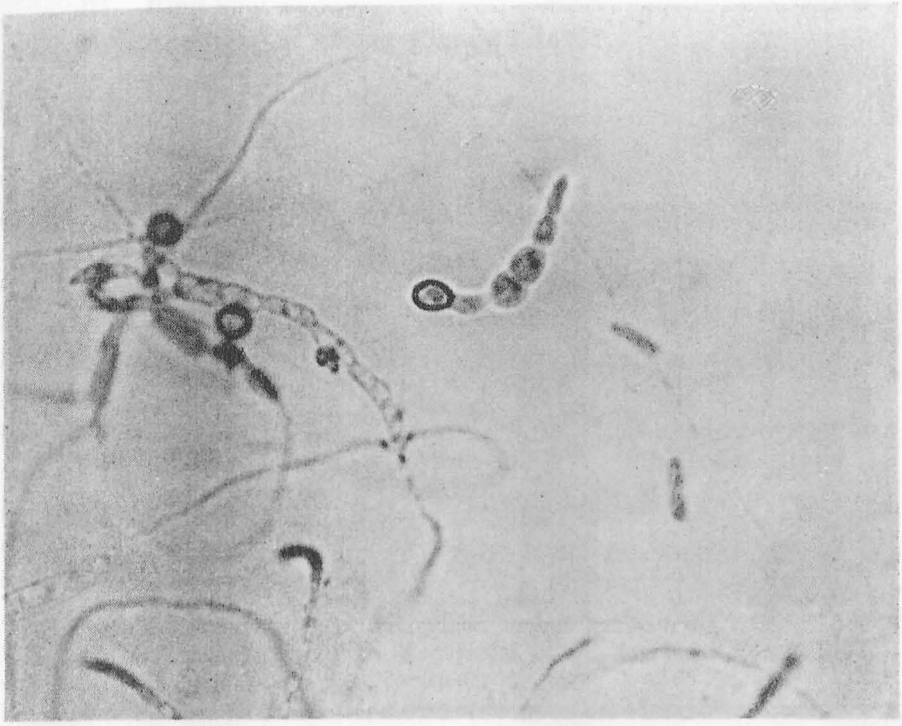

Fig. 10. Germination of the conidia of *Glomerella* sp. in tap water at room temperature, showing the formation of septa and appressorium (x 640).

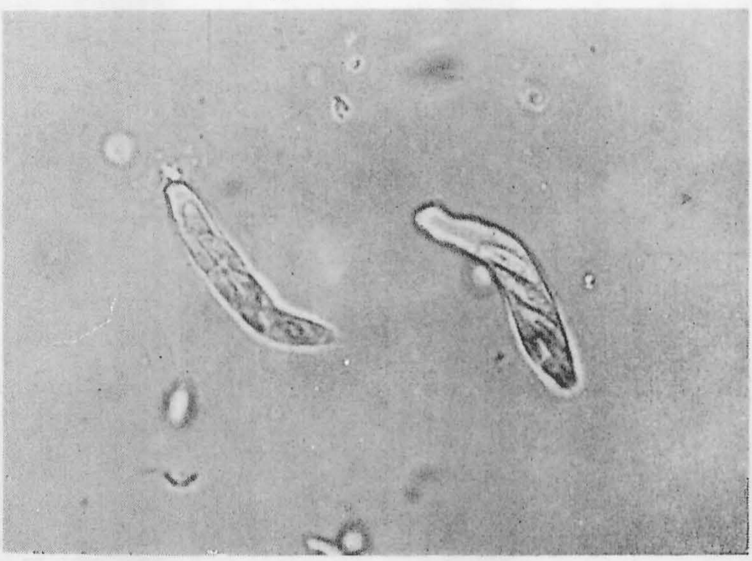

Fig. 11. Two asci of *Glomerella* sp. each containing 8 single-celled biseriate ascospores (x 640).

III. Ring spot of apple and pear—*Macrophoma kuwatsukai* Hara Figs. 12 to 18.

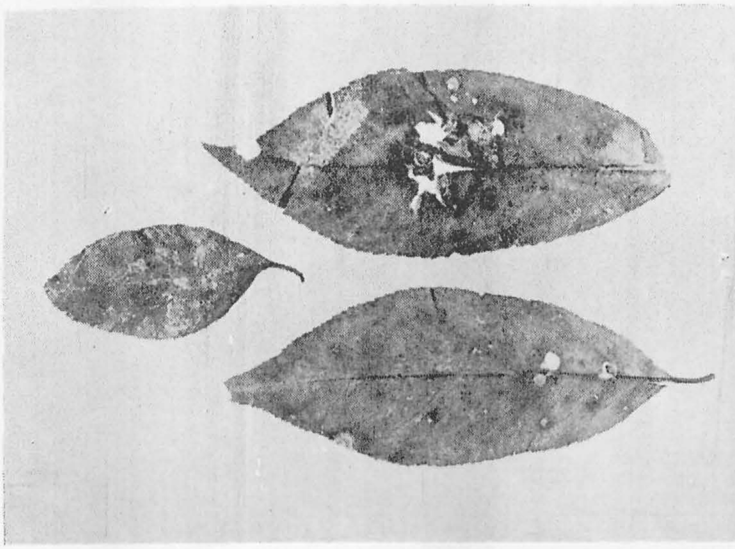

Fig. 12. A sample of the peach leaves harbouring a ring spot fungus disseminated by American planes in Hsiu-Yen Hsien, Northeast China.

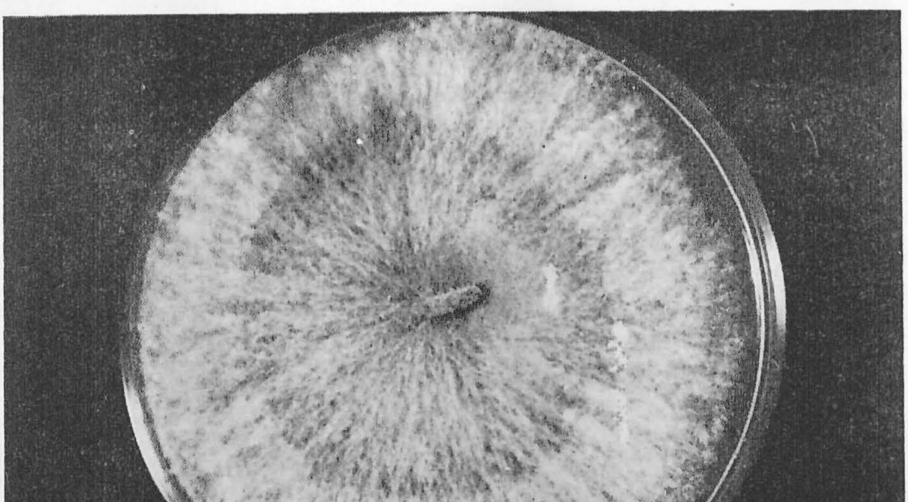

Fig. 13. From the disseminated leaves, a ring spot fungus, identified as *Macrophoma kuwatsukai* Hara, has been isolated. This shows a colony of the fungus growing on potato dextrose agar medium in a petri-dish.

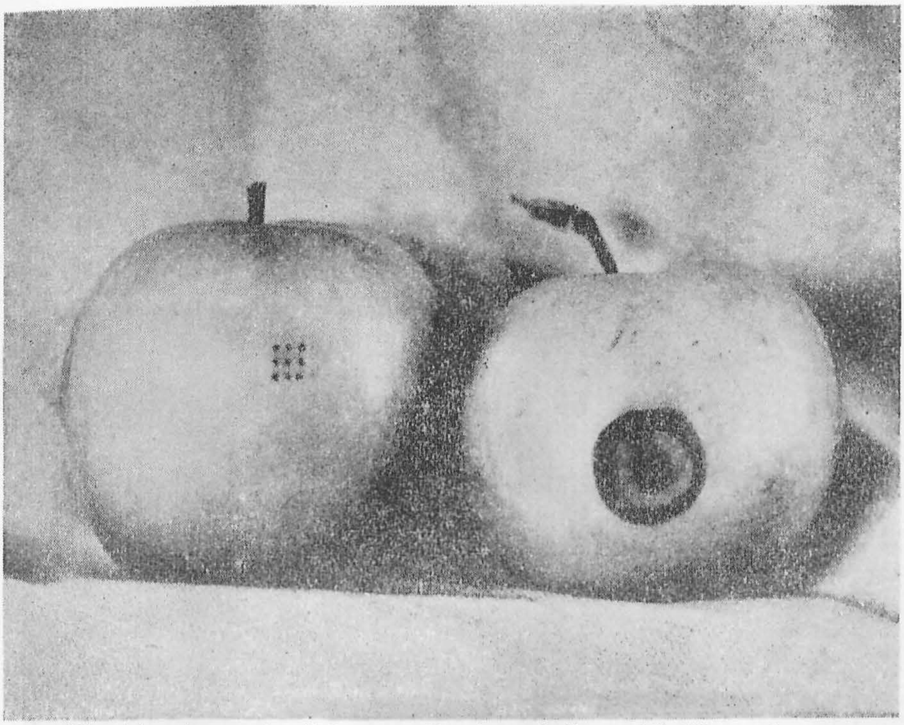

Fig. 14. An apple 48 hours after inoculation with *Macrophoma kuwatsukai* Hara (by puncture) showing circular brown lesion. Left: control. Right: inoculated.

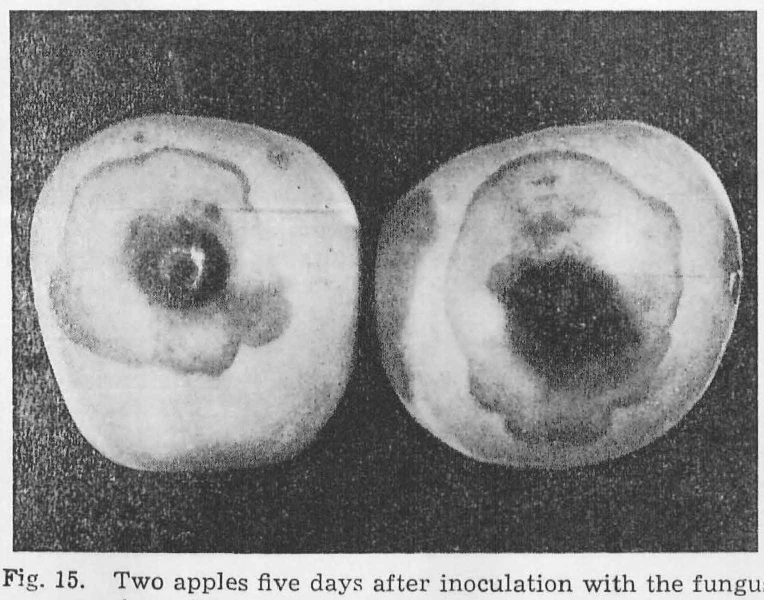

Fig. 15. Two apples five days after inoculation with the fungus culture into a small cut showing the ring spots.

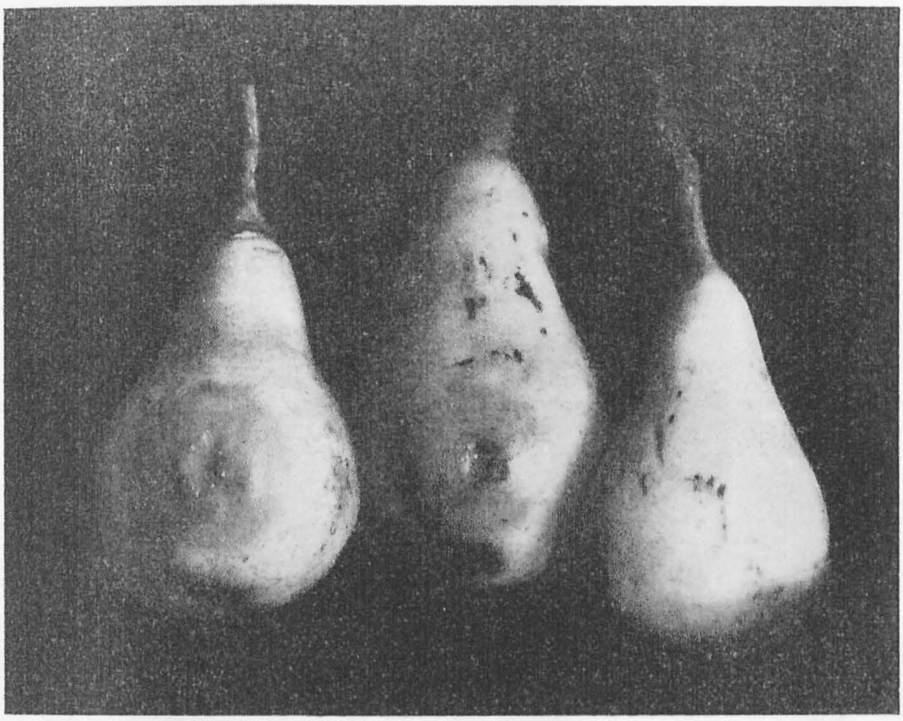

Fig. 16. Large lesions are produced on pears 48 hours after inoculation with the same fungus (by surface contact). Left: two fruits inoculated. Right: control.

Fig. 17. One apple shoot (marked by a cross) 48 hours after inoculation with the same fungus showing the die-back. The control shoots remained healthy.

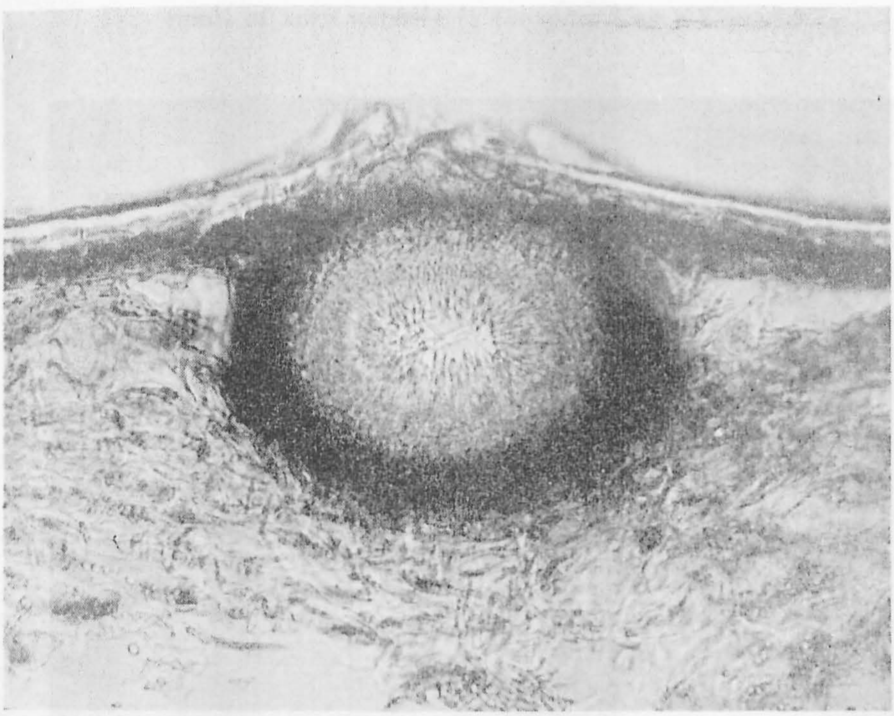

Fig. 18. Pycnidia of the ring spot fungus, *Macrophoma kuwatsukai* Hara, are produced in abundance at the center of the lesion on an apple 6 days after inoculation by inserting the fungus into a cut. This shows a cross section of a pycnidium in the host tissue (x 150).

IV. Smut of corn kernels (*Thecaphora* sp.) Figs. 19 to 20.

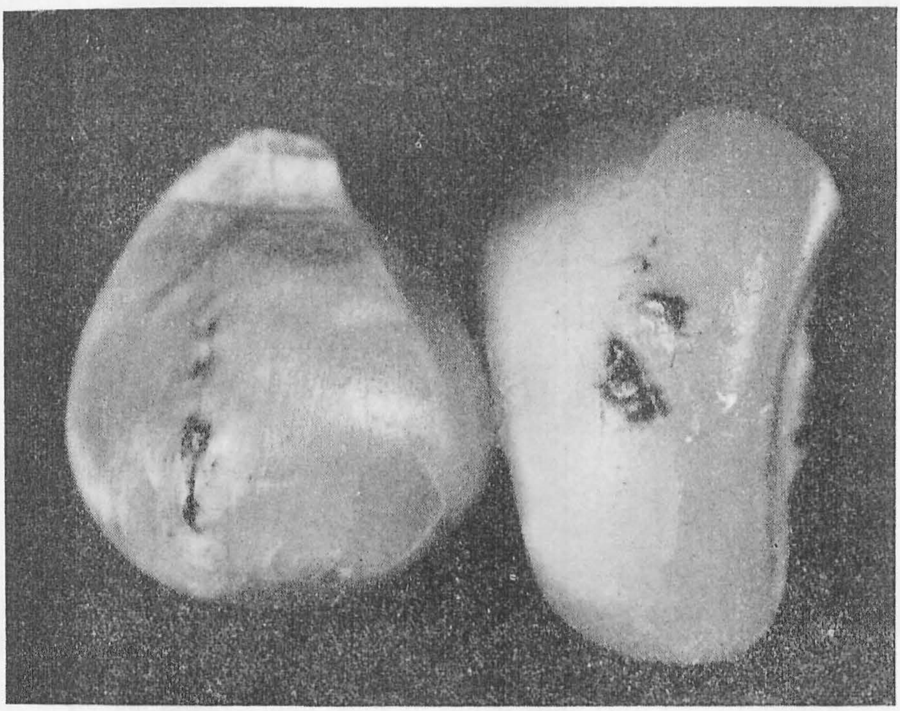

Fig. 19. Two corn kernels bearing sori of the smut, *Thecaphora* sp.

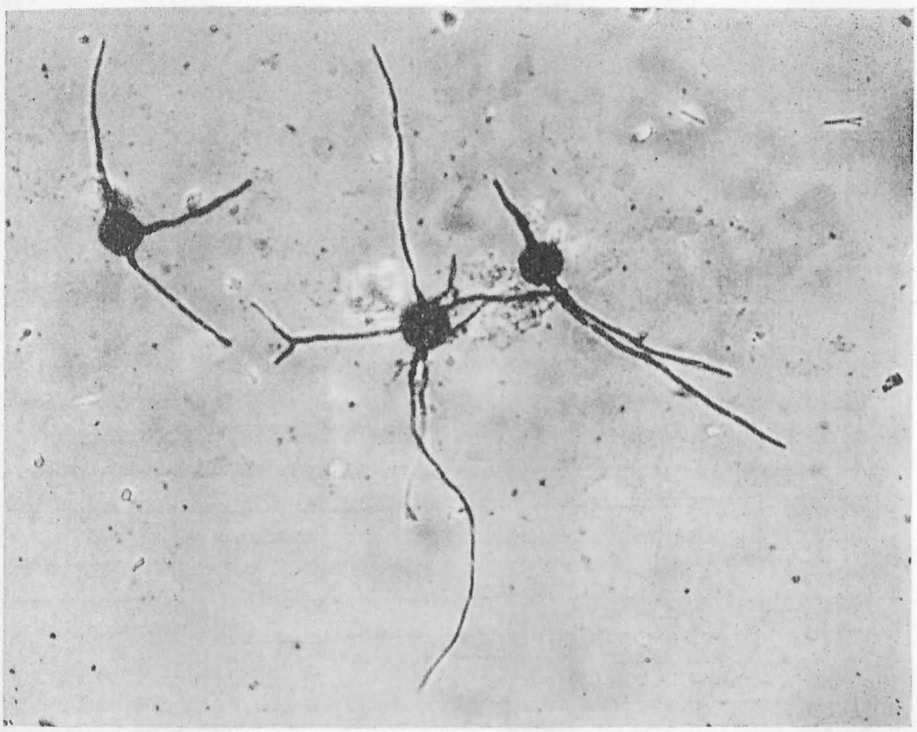

Fig. 20. Spore balls of *Thecaphora* sp. in germination showing septate promycelium being produced from each chlamydospore (x 250).

APPENDIX Jb

Report on Two Kinds of Leaves of South Korean Plants Disseminated by U.S. Military Planes in the Northern Part of Korea and Northeast China

(ISCC/7b)

Among the plant materials disseminated by the American planes in North Korea and Northeast China, we have found the leaves of a local form of *Lindera glauca* Bl. and leaves of *Quercus aliena* Bl. var. *rubripes* Nakai; these two plants are distributed in South Korea.

I. *Lindera glauca* Bl.

Dissemination of leaves as witnessed.—On May 3, 1952, at Lien Shan Village, sixth District of Hai-loon hsien, Liao-tung Province, Northeast China, an inhabitant, Li Chun-Kwei, saw four American planes flying from north to south, dropping large quantities of leaves.

Identification of the disseminated leaves.—These leaves are mainly those of common oaks (*Quercus dentata* Thunb., *Q. mongolica* Fisch. et var.). But among them we found one leaf of *Lindera glauca* Bl. The leaf of this lauraceous plant is characterized by elliptic-oblong blade with entire margins, slightly curved at the tip, with slightly lustrous upper surface, by the short petiole, by finely reticulate veinlets and by the lateral veins not reaching the margin. The lower surface of this leaf is rarely hairy or almost glabrous. By the last mentioned character this leaf is definitely identified as that of the local form of *Lindera glauca* Bl. of South Korea (Fig. 1).

Distribution of *Lindera glauca* Bl.—This Korean form of lauraceous plant is distributed south of 38 parallel of latitude. At 38 parallel of latitude this plant is restricted only at several places along the western coast. It has never occurred at any place in Northeast China. Outside of Korea this species also occurs in Japan and South China. This form is, however, confined to South Korea.

II. *Quercus aliena* Bl. var. *rubripes* Nakai

Dissemination of the leaves.—At 11 a.m. on Feb. 28, 1952, at Dai-Tek San, Korea, a Chinese People's Volunteer, Wu Yao-chuen witnessed

two American planes scattered large quantities of leaves. They covered an area of about one square kilometer. We received a fragment of leaf from Professor Chang Ching-Yueh of Peking University, who personally brought it back from North Korea.

Identification of the disseminated leaf.—After careful examination of the leaf-fragment, it is identified as *Quercus aliena* Bl. var. *rubripes* Nakai, a deciduous oak (Fig. 2). This variety is characterized by:

(1) Leaf-stalk 1-2 cm. long, flattened above, slightly channelled near the base, reddish in color, distinguishable even when dry.

(2) Leaf-base entire, both sides usually slightly unequal, leaf slightly lustrous on its upper surface, with greyish-white matted woolly hairs covering its lower surface.

(3) The central primary vein prominent on both surfaces of the leaf.

By the matted woolly hairs covering the lower surface of the leaf, by the central primary vein prominent on both surfaces and by the color of the leaf-stalk, central primary vein and lateral veins this variety differs markedly from all other varieties and forms of *Quercus aliena* Bl.. A complete specimen of this variety sent by exchange from the herbarium of the Imperial University of Tokyo, collected on August 30, 1900, at Inchon of Korea by Uchiyama is preserved in the herbarium of Academia Sinica. After comparing this fragment in question with this specimen, it is certain that our identification is correct (Fig. 3).

Distribution of *Quercus aliena* Bl. var. *rubripes* Nakai. In Korea, this plant is strictly confined to the South of 38 parallel of latitude (Cholla Buk Do, Choong-Ching Nam Do, Kyong-Ki Do), and not found north of it.

By the above-mentioned facts it is certain that the plant materials were disseminated by American planes.

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Kuang Ko-zen
Research Associate, Institute of Systematic Botany, Academia Sinica.

Liu Tchen-ngo
Director of the Botanical Institute, Northeast College of Agriculture.

Date of Report: Aug. 15, 1952.

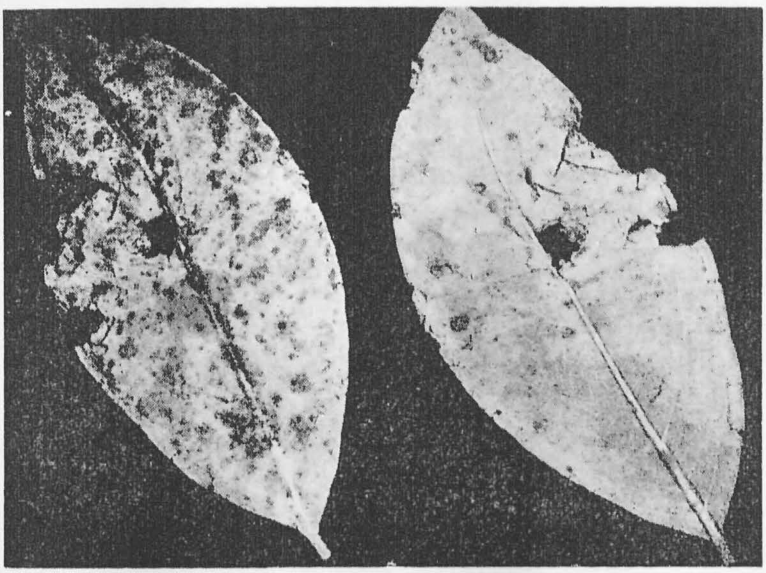


Fig. 1. Leaves of *Lindera glauca* Bl. disseminated by American planes at Hai-Loon Hsien, Liao-Tung Province. This form of lauraceous plant is only distributed south of 38 parallel of latitude; it is never known at any place in Northeast China.

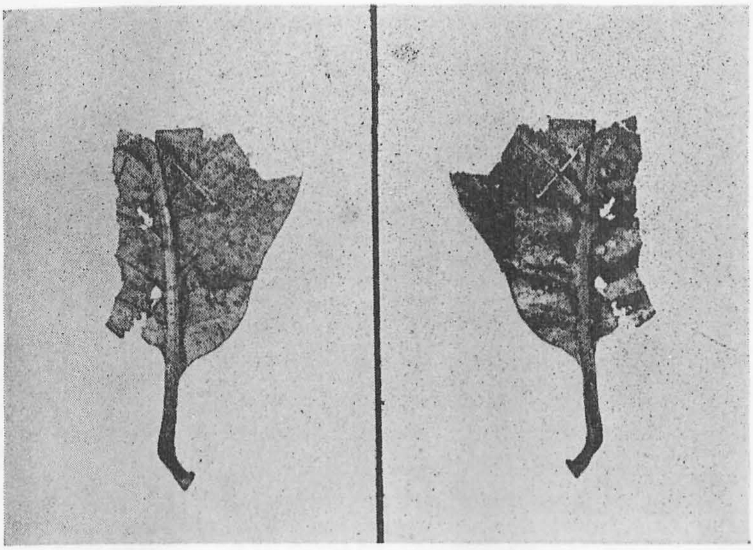


Fig. 2. The leaf fragment of *Quercus aliena* Bl. var. *rubripes* Nakai disseminated by American planes at Dai-Tek San, northern part of Korea. This plant is strictly confined to the south of 38 parallel of latitude in Korea.

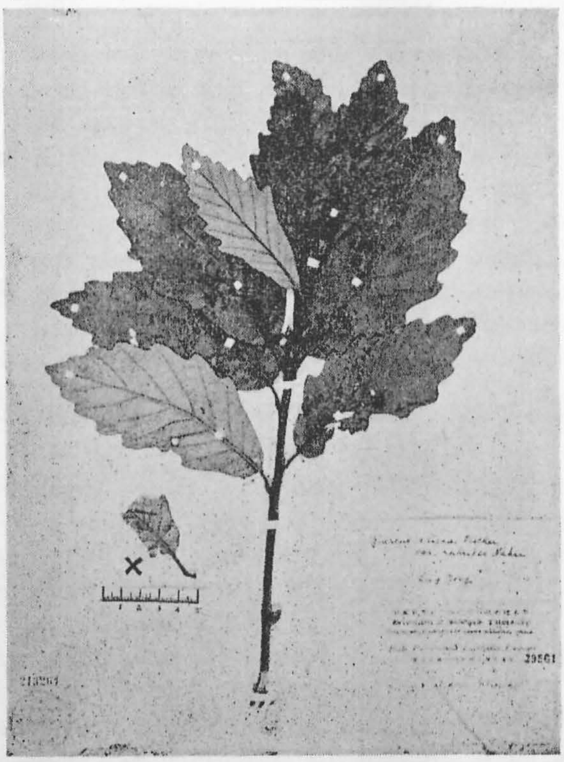


Fig. 3. Comparison between the disseminated leaf fragment (×) and the complete herbarium specimen of *Q. aliena* Bl. var. *rubripes* Nakai presented by Tokyo Imperial University and preserved by Academia Sinica (Collected from Inchon Korea by T. Uchiyama, 30 Aug. 1900).

APPENDIX K

"Report on Plague in Changteh, Hunan"

(Dec. 12th 1941)

(ISCC/1)

by Dr. Chen Wen Kwei
Emergency Medical Service Training School,
Head, Dept. of Laboratory Medicine,
Kweiyang, Kweichow.

(I) PREAMBLE—CIRCUMSTANCES LEADING TO THE SUSPICION OF PLAGUE:

On November 4th, 1941, at about 5 a.m. a single enemy plane appeared over Changteh, flying very low, the morning being rather misty. Instead of bombs, wheat and rice grains, piece of paper, cotton wadding and some unidentified particles were dropped. These materials fell chiefly in the Chi Ya Hsiang and Kwan Miao Street, (Area "A" in map) and around the East Gate district (Area "B" in map) of the city. After the all clear signal (5 p.m.), specimens of rice grains were collected and sent by the police to the Kwangteh Hospital for examination, which revealed the presence of micro-organisms reported to resemble *P. pestis*. (This was, however, shown to be erroneous by Dr. Chen Wen-Kwei later). Although the finding was by no means conclusive, suspicion that the enemy had scattered plague-infective material was in the mind of the medical workers who saw the incident on the spot.

(II) REPORT OF SUSPECTED AND PROVEN CASES OF BUBONIC PLAGUE:

Nothing happened until November 11th, seven days after the "aerial incident" when the first suspicious case of plague came to notice. This was a girl of eleven years old, living in Kwan Miao Street (Area "A" in map), complaining of high fever (105.7 F.) since November 11th. She was admitted to the Kwangteh Hospital. No other positive clinical finding was recorded but direct blood smear examination was said to have revealed the presence of *P. pestis* like organisms. She died on the 13th of November and post-mortem examination showed highly suspicious evidences of plague, smears from internal organs exhibiting similar organisms to those found in the blood (Case No. 1-Table).

On November 13th, another case was found dead. On enquiry the patient had high fever on November 11th and died on November 13th. Liver puncture was performed. Direct smear examination showed the presence of micro-organisms resembling plague bacilli. This patient was living on Chang Ching Street in the East Gate district (Area "B" in map) (Case No. 2-Table).

Two more cases came to notice, both with high fever and enlargement of glands in the groin ("buboes") beginning on November 12th. Smear examination of gland puncture fluid showed the presence of plague-like micro-organisms in both cases. One died on the 13th and the other on the 14th. Both lived in the East Gate district (Area "B" in map) (Case Nos. 3 and 4-Table).

The fifth case, admitted to the Isolation Hospital on November 19th, had fallen ill with fever and delirium (and buboes) on November 18th. He died on the day of admission. Autopsy revealed apparently negative findings. (Case No. 5-Table).

The sixth case, a man of 28, living in Kwan Miao Street (Area "A" in map) came down with fever, malaise and buboes on November 23rd and died the next day. This case was proved by Dr. Chen Wen-Kwei, Head of the Department of Laboratory Medicine, Central Training School, who had just arrived from Kweiyang with an investigation unit, to be genuine bubonic plague by post-mortem findings, confirmed by culture and animal tests (Case No. 6-Table and Document K-1).

All these cases were natives of Hunan and had lived in Changteh or in its immediate environs for years.

Since then to date no fresh cases of plague have come to notice.

CONCLUSION:

The last case seen was proved to be bubonic plague. The clinical history and smears from five other cases leave little doubt that they were also cases of plague.

(III) INFORMATION GATHERED FROM INVESTIGATION AND ENQUIRY:

a. General information:

Changteh is a city situated on the western shore of the Tung Ting Lake, directly on the northern bank of the Yuan River. Formerly, highway connections were available between this city and Hupeh province in the north, Changsha in the east and Taoyuan and other cities

in southwest Hunan. At present all the highway communications have been cut and the nearest highway is at Chengchiachi (60km) to the southwest by river. River traffic to Changsha via the Tung Ting Lake, and to Yuanling and Chihchiang via the Yuan River is still open. At present, therefore, communications with Changteh is only possible by boat or by footpaths.

Changteh has hot summers and cold winters which begin early in November. At the time of enquiry, atmospheric temperature ranged between 40-50°F.

Changteh was an important business centre in northern Hunan but since the war its prosperity has been much reduced due to frequent enemy air-raids and the cutting off of highway communications.

b. Medical Institutions at Changteh:

Kwangteh Hospital—a missionary hospital of 100 beds.

Hsien Health Centre (Wei-Sheng-Yuan) holds out-patients clinics.

An isolation hospital of 50 beds was established after the outbreak of plague.

c. Medical Statistics:

Changteh has now a population of about 50,000. No mortality statistics are available. It is known to be an endemic centre of cholera, and cholera epidemics have arisen from year to year.

There has been no noticeable increase in human deaths prior to the 'aerial incident'.

Since the first suspicious death from plague, records were kept of deaths in the city by the Hsien Health Centre, information being obtained from the police and coffin dealers. From November 12th-24th, seventeen deaths were reported in all, including those suspected of plague. No information was available about the causes of the other deaths.

d. Environmental Sanitation:

General sanitation of the city is rather poor. Frequent air-raids have destroyed many houses. Most new houses are built of wood and provide easy access to rats.

Area "A": Kwan Miao Street and Chi Ya-hsiang region (see map). This district is almost in the heart of the city and habitations are over-crowded. Streets are narrow and dirty. Several of the houses

in which plague deaths had occurred were visited and found to have dark and poorly ventilated rooms with no floors. Garbage accumulations were commonly seen in the corner of the rooms. Rat holes were found everywhere. Other houses did not differ in general appearance from those described.

Area "B": East Gate region (see map). Although less crowded, this district was even less impressive, being the living quarters of the poorer class. Environmental sanitation did not differ materially from Area "A".

On enquiry it was elicited that no conspicuous increase of dead rats was found either prior to or during the present outbreak. An Indian "wonder" rat-trap was set in one of the plague-death houses for three successive nights but no rats were caught. Some 200 rats were "bought" from the people and dissected but none of them showed any evidence of plague infection. These rats could not be traced to their place of origin. Many "tangle-foot" flea traps were also set in the houses in which plague death had occurred, but failed to catch any fleas.

SUMMARY OF FINDINGS IN SIX CASES OF BUBONIC PLAGUE IN CHANGTEH, HUNAN, CHINA

(For detail See Documents K-1 & K-2)

Case No.	Name of Patient	Sex	Age	Place of Occurrence	Date of Onset of Disease	Result	Clinical & Laboratory findings	Diagonosis	Seen by
1.	Tsai Tao-erh	F.	11	Area A*	Nov. 11, 1941	Died Nov. 13, 1941	High fever; blood smear (Wright's Stain) positive for **P. pestis** morphologically. Autopsy: spleen and liver enlarged, smear (W.S.) positive for P. pestis morphologically	? plague	Dr. Tan Hsueh-hua (Kwangteh Hosp. Changteh). Autopsy: Drs. Tan and P. K. Chien (RCMRC Group II, leader).
2.	Tsai Yu-chen	F.	27	Area B**	Nov. 11, 1941	Died Nov. 13, 1941	High fever; seen dead. Liver puncture smear (Wright stain) positive for **P. pestis** morphologically	? plague	Dr. Kent (RCMRC)
3.	Nieh Shu-sheng	M.	58	Area B	Nov. 12, 1941	Died Nov. 13, 1941	Fever; enlarged groin glands, smear (W.S.) positive for **P. pestis** morphologically	? plague	Dr. P. K. Chien
4.	H su Lao-san	M.	25	Area B	Nov. 12, 1941	Died Nov. 14, 1941	High fever; enlarged groin glands; smear (W.S.) positive for **P. pestis** morphologically	? plague	Dr. Fang Teh-cheng (Changteh Wei Sheng Yuan) & Dr. H. H. Tan.
5.	Hu Chung-fa	M.	?	Area A	? Nov. 18 1941	Died Nov. 19, 1941	Fever; delirium; ? enlarged groin glands. Autopsy: Findings: ?? splenic smear (Gram's stain) negative; culture negative.	? ? plague	Dr. Fang Teh-chen Autopsy: Drs. H. H. Tan & M. N. Shih (Div. II, Anti-Epidemic Corps, W.S.S.)
6.	Kung Tsao-sheng	M.	28	Area A	Nov. 23, 1941	Died Nov. 24, 1941	Fever; malaise; enlarged and tender right groin glands. Autopsy: spleen enlarged with hemorrhagic spots; liver and intestine with hemorrhagic spots; pleural and pericardial effusion. Direct smear of heart blood, rt. inguinal gland, liver and spleen (Gram's and carbol-thionin blue stain) positive for **P. pestis** confirmed by culture and guinea-pig inoculation.	Plague (Bubonic)	Dr. Lee Ching-chieh (4th EMSTS & 4th Sanitary Corps) Autopsy: Drs. W. K. Chen, B. Liu & Y. K. Hsueh (Central EMSTS & RCMRC). Culture & guinea-pig inoculation by Dr. W. K. Chen.

* Area A-Kwan Miao Street region (see Map)

** Area B-East Gate region (see Map).

RCMRC—Red Cross Medical Relief Corps.

EMSTS—Emergency Medical Service Training School.

W.S.—Wright's Stain.

(IV) DISCUSSION AND CONCLUSIONS:

(1) Was plague present in Changteh?

a. That plague was present in Changteh was proved by the case of bubonic plague investigated by Dr. Chen Wen-kwei who had special training in plague work in India. This case, a man of 28 years old, was seen sick with high fever and "buboes" on November 24th and died the same evening. He came to stay in the "infected" area on November 19th and fell sick on November 23rd. On post-mortem examination he was found to have died of bubonic plague. Direct smear, culture and guinea-pig inoculation test of material taken from groin lymph-nodes, spleen, liver and heart's blood all confirmed the diagnosis. (For detail protocol see Document K-1).

b. That an epidemic outbreak of plague has taken place between November 11th and 24th was also evident from the discovery of five suspicious cases referred to above. It may be argued that none of these were bacteriologically confirmed by animal inoculation tests, but the clinical history with high fever, enlarged lymph-glands in the groin ("buboes") and smears from either lymph-glands, liver or spleen being positive for *P. pestis* morphologically and their rapidly fatal course (death within 24-48 hours after onset of the disease), leaves little or no doubt about their being actual cases of plague. Moreover, most of the cases occurred at about the same time. Hence an epidemic outbreak of bubonic plague did exist beginning from November 11th, seven days after the "aerial incident".

All smears were re-examined by Dr. Chen Wen-kwei who confirmed the finding of plague-like bacilli.

(2) How did the plague outbreak arise?

Could any connection be established between the outbreak and the alleged infective material scattered by the enemy plane on November 4th, 1941?

Three possibilities may be enquired into, namely,

I. Did plague exist prior to the "aerial incident"?

II. Did plague come to Changteh from contiguous districts known to be plague stricken?

III. Was the plague due to the scattering of infective material from the enemy plane on November 4th, 1941?

I. That the present outbreak of plague may be due to a local disease having suddenly broken out into epidemic proportions is out of

the question because Changteh has never been, as far as is known, afflicted by plague. During previous pandemics and severe epidemics elsewhere in China, this part of Hunan, and Central China in general, have never been known to come under the scourge of the disease. Spontaneous plague is not known.

II. That the present outbreak may have been due to direct contiguous spread from neighbouring districts known to be plague stricken is also untenable on epidemiological grounds. Epidemiologically, plague spreads along transport routes for grain on which the rats feed. Ships form good carriers of rats because they contain cargo and form good harbourages for these animals. Hence the coastal towns of Fukien and Kwangtung provinces were usually the first to become infected by plague from other plague-stricken ports, the disease gradually spreading inland later. Epidemic foci now exist in certain districts of Fukien and Chekiang and a few cities of Kiangsi bordering the former two provinces. The plague infected city nearest to Changteh, is Chuhsien in Chekiang, about 2,000 km. away by land or river communication. Incidentally, it may be noted that the plague in Chuhsien is also attributed to infective material dropped by enemy planes in 1940. With the existing state of communication, it is not possible for plague to spread from Chuhsien to Changteh. Besides, all the cases occurring in Changteh were native inhabitants of that city and as far as can be ascertained, were not known to have been away from the city or its immediate environs at all. Changteh, being a rice producing district, furthermore supplies rice to other districts and does not receive rice from other cities. It is clear, therefore, that the present outbreak of bubonic plague in Changteh is native in origin.

III. That the enemy scattered plague material from the plane on November 4th, 1941, at 5 a.m. and caused the epidemic outbreak of plague beginning on November 11th, is probable for the following reasons:

1. All the cases came from the areas where the grain, etc., dropped by enemy plane were found.

2. Among the wheat and rice grains and rags of cotton and paper scattered there were most probably included infective vectors, probably fleas. The latter was not found by those who swept and burned the material, because:

a. Lay people did not know the possibility of dangerous and infective fleas being scattered down and therefore did not look for them.

b. The air-raid alarm on November 4th lasted from 5 a.m. to 5 p.m. with the result that the fleas must have in the meantime escaped from the rags and grains and hid themselves in nearby houses of more equable temperature and humidity long before the grains and rags were swept and burnt after the all-clear signal.

3. Plague might be caused by infective material in one of three ways:

a. Grains thrown down may be infected with plague organisms which when eaten by local rats cause infection among them. Later, the infection is transmitted from the diseased rats to the rat-fleas and these in turn infect men through their bites.

This was unlikely or unsuccessful for two reasons:

i. Grains collected and submitted to cultural and animal inoculation tests have to date been found negative for plague organisms (Document K-3).

ii. There was apparently no evidence of any excessive rat mortality since the "aerial incident".

b. Infected fleas may have been thrown down together with the grain and rags. The grain attract the local rats which offer refuge to the infective fleas and thereby become infected. Local fleas then become infected and further infect rats and men.

Apparently this did not take place since:

i. All the human cases of plague were infected within 15 days after the "aerial incident". Normally human plague cases begin to appear at least two weeks after the rat epizootic which also takes time (say two weeks) to develop.

ii. There was no apparent rat epizootic preceding or during the human outbreak as already referred to.

If infected fleas were released from the plane, what prevented them from starting an epidemic among the local rats? In order that a rat epizootic may take place, it is necessary that the flea population or rat flea (*Xenopsylla cheopis*) index should be high. Although no data are available concerning the normal rat-flea index in Changteh, it is probable in view of the cold weather, that it was not high enough to cause rapid spread of the disease among the rats. It is not yet known whether the rats of Changteh have become infected with plague. Further research is necessary.

c. Infected fleas thrown down with the grain, etc., may have bitten human individuals directly and caused the outbreak of plague.

The evidence of this mode of transmission seems complete:

i. The normal incubation period of bubonic plague, i.e. the interval between the bite of the infective flea and the onset of disease, is 3-7 days, but may occasionally be prolonged to 8 or even 14 days. Most of the cases seen had an incubation period of 7-8 days, which would indicate that these individuals were bitten by the infective fleas very soon after they were released probably on November 4th or 5th. Thus the first case had its onset on November 11th, seven days after the "aerial incident". Similarly with the second case. The third and fourth cases fell ill on the 12th, eight days after the "incident". The fifth case, about which the diagnosis was more doubtful than any other, fell sick on November 18th (?). The proven case had been working in a nearby village and came into the city to live in one of the infected areas on November 19th. On November 23rd, five days after entering the infected area, and 15 days after the "aerial incident" he fell ill. Assuming he was bitten on the 19th, the question arises, as to whether the infective fleas could have survived from November 4th up to November 19th. The answer is in the affirmative, for it is known that infected fleas can live under suitable condition for weeks without feeding.

ii. All the human cases were inhabitants of the area where grain, etc. dropped by the enemy plane were found.

From the evidence presented the following conclusions may be drawn:—

1. That plague was epidemic in Changteh from November 11th to 24th, 1941.

2. That the cause of the epidemic was due to the scattering of plague infective material, probably infective fleas, by an enemy plane on November 4th, 1941.

DOCUMENT K-1

CLINICAL AND AUTOPSY NOTES OF THE PROVEN CASE OF BUBONIC PLAGUE

Name of Patient:	Kung Tsao-sheng
Date of autopsy:	November 25th, 1941.
Place:	Isolation Hospital, Changteh.
Operator:	Dr. W. K. Chen
1st Assistant:	Dr. Y. K. Hsueh
2nd Assistant:	Dr. B. Liu
Recorder:	Dr. C. C. Lee

Clinical History of the Patient:

The patient, a male of 28, lived in a small lane in front of the Kwan Miao Temple, and used to work in a village outside Changteh. He returned to the city on November 19th, 1941, on account of the death of his mother six or seven days before. The cause of her death was not definitely known (? tuberculosis—long standing illness with severe emaciation). He felt unwell in the evening of November 23rd, and experienced feverishness and headache with malaise at about 11 p.m. The next morning he complained of pain and tenderness in the right groin for which a Chinese plaster was applied. He vomitted once during the afternoon, and from then on his condition grew rapidly worse. Dr. C. C. Lee of the 4th Emergency Medical Service Training School and the 4th Sanitary Corps, was called in at 7 p.m. to see the patient, and found him to be dying. Important findings on examination were high fever, and enlarged and tender glands in the right inguinal region. Plague was strongly suspected. The patient was to have been sent to the Isolation Hospital, but he died at 8 p.m. before he could be removed. With the aid of the police, the body was brought to the Wei Sheng Yuan by 10 p.m. where disinfection of clothing and bedding was carried out in order to kill fleas. The plaster covering the groin was removed; cardiac puncture and aspiration of the right inguinal gland were performed for culture under sterile technique, and, since the light was inadequate, autopsy was postponed until the next morning. The body was laid in a coffin with the lid nailed down.

Autopsy Findings:

1. General Appearance: The cadaver was medium-sized and appeared very thin.

2. Skin: Face was slightly blue, and lips cyanotic, No petechial spots or flea-bite wounds were seen. Lesions resembling scabies in the right popliteal region.

3. Lymph Glands: The right inguinal glands were enlarged. Mesenteric lymph nodes also slightly enlarged.

4. Chest Findings: Lungs normal in gross appearance. There was fluid estimated at 20 c.c. approximately in each pleural cavity. Pericardial effusion of about 20c.c. also present. Heart very flabby but not enlarged. Cardiac puncture through the right auricle performed under sterile technique and a few c.c. of blood were obtained and inoculated on blood agar slant.

5. Abdominal findings: Liver firm. Spleen enlarged to twice its normal size. Kidneys normal.

   Haemorrhagic spots seen on the surface of liver, spleen and intestine. No free fluid in the abdomen.

Bacteriological Findings:

Specimens of right inguinal glands, liver, spleen and blood were taken for direct smears, culture and animal tests.

1. *Direct Smears:* Carbol-thionin blue and Gram's method of staining were employed for all the smears. 50% ether in absolute alcohol was used for fixation. Under the microscope many oval-shaped Gram negative bacilli with their polar regions deeply stained were found.

2. *Cultivation:* Under sterile technique, specimens of cardiac blood, inguinal glands, liver and spleen of the patient were inoculated on blood agar slant of pH7.6 and incubated in a wide mouth thermos bottle. Temperature was regulated at 37° centigrade. Twenty-four hours later, many minute greyish-white opaque colonies were found on the surface of the media. All were pure cultures. Smear examination showed Gram negative bipolar staining organisms.

3 *Animal Inoculation Test:*

a. Guinea-pig No. 1: The animal was inoculated by smearing splenic substance of the cadaver on its right flank which was newly shaven at 3 p.m. on November 25th, 1941 (the splenic substance was found to contain many Gram negative bipolar staining bacilli). The animal began to develop symptoms at 8 p.m. on November 26th, and was found dead in the early morning of November 28th. Thus the incubation period was not more than 29 hours, and the whole course of the disease ran at most 32 hours.

Autopsy findings:

1. Skin: Swelling and redness at the site of inoculation.
2. Lymph glands: Bi-lateral enlargement of inguinal glands, more marked on the right side with congestion.
3. Subcutaneous Tissues: Edematous and congested. Haemorrhage at the site of inoculation.
4. Chest Findings: Not remarkable.
5. Abdominal Findings: Spleen enlarged and congested. Liver, kidneys and G.I. tract also congested.

Specimens of heart blood, liver, spleen and inguinal lymph glands were taken for smears and culture.

Microscopic examination of the stained smears (Carbol-thionin blue and Gram's stains) revealed Gram negative bipolar staining bacilli similar to those seen in the direct smears made of autopsy material from the patient.

Culture of these specimens on blood agar slants at pH7.6 was made. Twenty-four hours later, pure cultures of similar organisms were found.

b. Guinea-pig No. 2: This animal was similarly treated as guinea-pig No. 1 at 9 a.m. on November 26th, but the inguinal gland of the cadaver was used instead. Symptoms were first noticed at 8 a.m. on November 28th, an incubation period of 47 hours. Death of the animal occurred 44 hours later (in the morning of November 30th).

Autopsy of the animal showed the same gross pathological changes as those of guinea-pig No. 1. Direct smears of lymph glands, liver, and spleen showed similar findings.

c. Guinea-pig No. 3: This time a pure culture of the organisms was used to smear on the newly shaven left flank of the guinea-pig. (The culture was obtained by growing the cadaver's blood on blood agar slant at pH7.6 for 24 hours). The animal appeared ill 45 hours later and was found dead in the early morning of November 30th. The course of the disease of the animal was, therefore, not more than 40 hours.

On autopsy, gross pathological changes were found to be similar to those of guinea-pigs Nos. 1 and 2 except that changes of lymph-glands and spleen were more pronounced.

Smear examination of heart blood, lymph-gland, liver and spleen yielded similar results.

Conclusion:

Clinical history, autopsy finding and bacteriological findings prove the patient to be a case of bubonic plague, dying from septicaemic infection from *Pasteurella pestis*.

DOCUMENT K-2

CLINICAL NOTES OF SUSPECTED PLAGUE CASES

Case 1 (Tsai Tao-Erh)

This patient, a girl of eleven, living in Tsai Hung Shen Charcoal Dealer Shop, Kwan Miao Street, was said to have fallen ill on November 11th, 1941, and was sent by the police to the Kwangteh Hospital at 7 a.m. the next day for treatment. On admission, she was seen by Dr. H. H. Tan and was found delirious. Temperature 105.7° F. Eczema of the right ear. No glandular enlargement or tenderness. Few rales were heard in the chest. Abdominal findings were said to be normal. Blood smears (Wright and Gram's Stains) showed organisms resembling *P. pestis* morphologically. Patient was then isolated and sulfanilamide treatment given. Her general condition turned from bad to worse in the morning of November 13th, when petechial spots of skin were noted. Blood smear examination was repeated and revealed the same result as before. At about 8 a.m. she died.

Essential features of autopsy were enlarged left infraauricular lymph nodes. No sign of pneumonia; liver and spleen enlarged with haemorrhagic spots on their surfaces. Kidneys were also hemorrhagic. Splenic smear showed similar findings as the blood smear. Culture of the splenic substances was done in the Kwangteh Hospital but no definite report was obtained.

Case 2 (Tsai Yu-Chen)

This was a woman of 27, living in Chang Ching Street East Gate district. She was said to have had an abrupt onset of fever on November 11th and died on the 13th. While her cortege was passing Tehshan, Dr. Kent of Red Cross Medical Relief Corps met it and made enquiry of the cause of her death. The above information led him to suspect plague. Post mortem liver puncture was done and smear examination showed organisms resembling *P. pestis* morphologically.

Case 3 (Nieh Shu-Sheng)

This was a man of 58, living in No. 1, 3rd Chia, 4th Pao, Chi Ming Cheng, East Gate district. Developed high fever in the evening of November 12th, complained of pain and tenderness in the groin on November 13th. Aspiration of the enlarged groin gland was done by Dr. P. K. Chien of Red Cross Medical Relief Corps and smear examination (Wright Stain) showed *P. pestis* like organisms. The patient died in the same evening.

Case 4 (Hsu Lao-San)

The patient was a man of 25, living in No. 5, 5th Pao, Yun An Hsiang, Yang Chia Hsiang, East Gate district. Became ill with fever and headache since November 12th. Seen by Dr. H. H. Tan and Dr. T. C. Fang and found to have tender and enlarged groin lymph glands the next day.

Aspiration of the gland was done in the Kwangteh Hospital and smear examination (Wright's Stain) showed *P. pestis* like organisms.

Case 5 (Hu Chung-Fa)

A man living in Chung Fa Hospital, Kwan Miao Street. In the morning of November 19th, he went to the Wei Sheng Yuan complaining of being infected with plague and demanding treatment. He appeared, at that time, quite irritable and spoke somewhat incoherently. His pulse rate was rapid, but fever was not high. He was immediately admitted to the Isolation Hospital. In the evening his temperature went up and he died.

Autopsy by Drs. H. H. Tan and M. N. Shih showed bluish discoloration of the skin, more marked over the chest and abdomen. No enlargement of lymph glands were noticed. Spleen was found to be slightly enlarged and other abdominal findings were not remarkable. Smear and culture of splenic material showed only Gram positive cocci and bacilli. It should be noted that Dr. Tan was working with inadequate culture media.

DOCUMENT K-3

NOTES ON EXAMINATION OF GRAINS DROPPED BY ENEMY PLANE

Examination of a sample of the grain dropped by the enemy plane over Changteh city on November 4th, 1941, 5 a.m. and collected from the ground next morning and examined after an interval of fully 34 days.

Gross Examination: The sample consists of barley, rice and unidentified plant seeds.

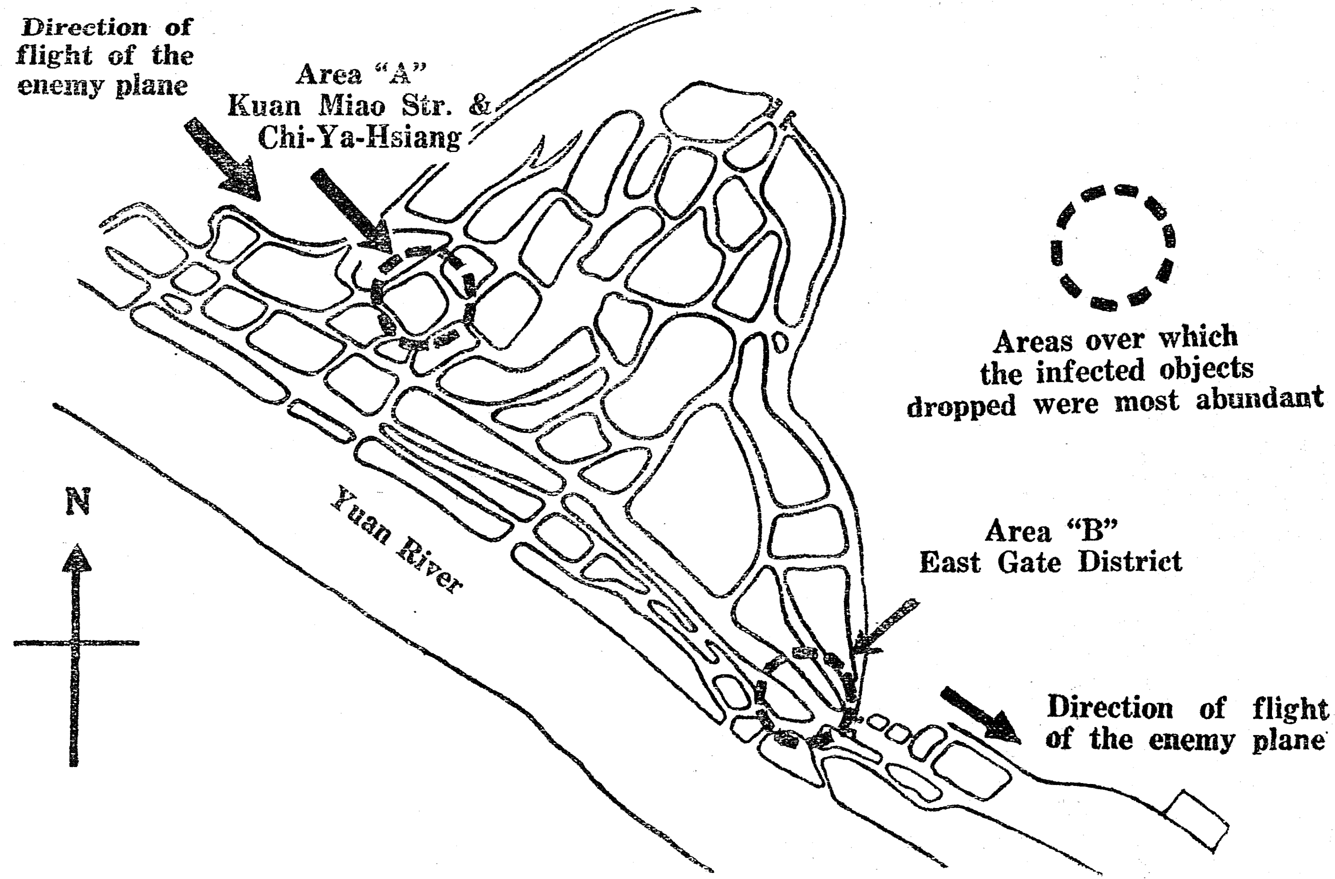
Culture Examination: The sample was put into a sterile mortar and ground with 5cc sterile saline. This mixture was cultivated on blood agar slants and copper sulphate agar slants (all pH7.6). After incubation at 37° C. for 24-48 hours, only contaminating organisms of staphylococci, B. coli and unidentified Gram positive bacilli with central spores were found; no *P. pestis* like organisms were found.

Animal Inoculation: Two cc of the above mixture were injected subcutaneously into a guinea-pig on December 8th, 1941, at 9 a.m. The testing animal died in the evening of December 11th after showing no sign of illness.

Autopsy Findings: On the morning of December 12th, autopsy of the dead animal was performed. Local inflammation, general congestion of subcutaneous tissue, inguinal lymph glands not enlarged, liver and spleen normal and not enlarged. Heart and lungs normal. Smears made from lymph gland, spleen and liver showed no *P. pestis* like organisms. Only Gram positive bacilli and some Gram negative bacilli were present.

Culture of heart blood of the dead animal showed unidentified Gram positive bacilli with central spores. *P. pestis* not found. Culture from the lymph nodes, spleen and liver showed pure culture of *B. coli* only. *P. pestis* not found.

Conclusions: By culture and animal inoculation tests, *P. pestis* is not present in the sample.



Text Fig. 1. Map of Changteh.

APPENDIX L

Memorandum on Certain Aspects of Japanese Bacterial Warfare

(ISCK/6)

by Dr. Chen Wen-Kuei

at Pyongyang, Korea

The use of bacterial weapons on a large scale by the American invaders both at the front and behind the lines in Korea, in the attempt to induce artificially epidemics for a mass slaughter of peaceful Korean people as well as the people's armed forces of Korea and China, has followed exactly the route opened by Japanese fascist war criminals in waging bacteriological warfare against humanity and in defiance of international conventions. That the airplanes of the American invading forces have in many instances disseminated human fleas (*Pulex irritans*), infected with plague, at the Korean front and in the rear, has been confirmed scientifically in various laboratories at different places by both Chinese and Korean experts. I myself have had the opportunity of taking part in this anti-bacteriological warfare and coming to Korea to examine the bacterial strains isolated by both Chinese and Koreans. I have also had the opportunity of isolating *Pasteurella pestis* from the human fleas dropped by American planes. The results uniformly confirmed each other.

It will be remembered that in the autumn of 1940, during the second world war, the Japanese invaders disseminated fleas carrying plague bacilli from airplanes over the city of Ningpo, Chekiang Province. Thus an outbreak of plague epidemic was induced in which 99 people came down with the disease and 98 died. According to the reports at that time, some had witnessed Japanese planes circling around over the city in the daytime and dropping objects from a low altitude. After the raid, one of the inhabitants found many fleas on the water-surface of the goldfish tank in his courtyard. These fleas were sent to the Chekiang Provincial Health Institute. Cultures were not made, as there was no bacteriologist at that place. Those specimens were then forwarded to the superior office together with a due official covering note from the Public Health Department of the provincial government. Later the Central Bureau of Health of the Kuomintang government declared that only the covering

note was received without the specimens of fleas, which were said (?) to have been lost on the way. But the Bureau of Health sent the Director of the Department of Epidemic Prevention and a German adviser to investigate the matter. As a result, while the true facts were kept secret under cover, the Public Health Department of the Chekiang Provincial Government was blamed for its incompetence in anti-epidemic work, and the plague at Ningpo was thought to have been transmitted from Fukien Province. I had pointed out at the meetings of the All-China Conference on Epidemic Prevention at Chungking that the Japanese invaders might employ infected fleas to spread plague (since in 1936 I learnt at the Haffkine Institute at Bombay, India, the artificial means for breeding and infecting rat fleas). I suggested at the same time that the health authorities should issue orders to put people on the alert, and to watch closely for the dissemination of fleas from enemy planes. Not only was this not accepted, but I received a severe warning as well as an order that I should not reveal top military secrets.

At that time, neither the Kuomintang Government nor the majority of the hygiene specialists took any responsibility to relieve such distress among the people, nor they did believe that the Japanese invaders would wage bacteriological warfare. On the contrary, they thought I was oversensitive. However at the end of 1941, Japanese airplanes again dropped over the city areas of Changteh large numbers of plague-carrying fleas in a mixture of cereal grains. I personally led an anti-epidemic unit to make an investigation at the spot. We arrived there three weeks after the morning when the Japanese invaders had disseminated the plague fleas. It was therefore impossible to collect any fleas, and we could only find cases of bubonic plague and deaths from septicaemia. I wrote a report on this incident which concluded by affirming from the epidemiological point of view that plague-carrying fleas had been among the objects dropped from enemy planes.

Because of the lack of material evidence, there was much criticism by those scientists who were purely technical-minded, though none of them could explain the source of the plague epidemic at Changteh. As it was too far away from the endemic area of Fukien, it could hardly be dismissed as was the case of the artificial epidemic of plague at Ningpo. The Kuomintang Government and its scientists were not interested in the misery suffered by the people at Changteh. They simply said that the evidence was not sufficient from a scientific point of view to incriminate the Japanese. Although my written report had been translated into English and distributed by my immediate superior to the Embassies of various countries in Chungking, the Director of the Anti-epidemic Department of

the Bureau of Health of the Kuomintang Government altered its contents and delayed its publication. Finally it was briefly mentioned in the "Epidemic Prevention Weekly", bearing the names of the Director and an Austrian adviser. The Kuomintang leaders knew that the Japanese aggressors had waged bacteriological warfare at Changteh and Ningpo, but under the bribery and pressure of the American imperialists they betrayed their own conscience and the welfare of their own people simply for their own benefit. They never repudiated, and did not dare to renounce the indiscriminate use of inhuman bacteriological warfare, which the enemy therefore used again on a large scale along the Chekiang-Kiangsi railway in Central China in the Autumn of 1942. In this episode, cholera was spread in addition to plague. The losses suffered by our people were inestimable.

When the Japanese aggressors surrendered unconditionally in 1945, the allied forces organised at Tokyo an International Court for the trial of Japanese war criminals. At that time, as I clearly remember, an American judge (whose name I have forgotten), came personally to Chungking to call on me and ask me to give him the "Report on the Plague Epidemic at Changteh". I was also asked to sign a copy of that report (which I did) as a preparation for the trial of those Japanese bacteriological war criminals. But the Kuomintang Government made no accusation. The International Military Court at Tokyo never afterwards mentioned the use of bacteriological weapons in China by the Japanese.

At the end of 1949, the Soviet Government instituted at Khaborovsk a trial of the twelve bacteriological war criminals, including Yamada Otozoo, the former Japanese commander-in-chief of the "Kuantung Army". In their testimonies it was proved that the enemy had used infected fleas at Ningpo and Changteh.

Now the plague-carrying fleas discovered in Korea by Chinese and Korean scientific workers have been proved to be human fleas, *Pulex irritans*. This led to the question whether those used by the Japanese bacteriological war criminals in China were also human fleas. This time, Professor Zhukov of the International Scientific Commission, after hearing my report, confirmed the fact that the bacteriological weapons used by the Japanese war criminals were indeed infected human fleas, entirely the same as those now used by the American aggressors. Thus I have twice had the opportunity to join in work against bacteriological warfare. The results attained today give me much satisfaction, because they explain the reason why the Americans deliberately protected the Japanese bacteriological war criminals. I am glad to be able to denounce the crime of these Japanese and American fascists bacteriological war criminals

and to call attention of the right-minded scientific workers of the world to it. The human fleas infected with bacteria which have been dropped on the already ruined land of Korea today, may fall upon the homes of their own countries tomorrow.

APPENDIX M

Report on Voles Infected with *Pasteurella pestis* Dropped by a U.S. Military Plane at Kan-Nan Hsien, Heilungchiang Province

(ISCC/2)

I. *Discovery of the voles and preventive measures*

On the morning of April 5th, 1952, voles of a kind never seen in the past was suddenly discovered in abundance in four villages, namely Min-chung, Kung-nung, Hsin-min and Kung-yi, of the Tenth District, Kan-nan Hsien, Heilungchiang Province. Bacteriological examinations proved the presence of *Pasteurella pestis* in them. The details are given as below:

At mid-night on April 4th, 1952 Ch'en Wan-fu, Liu Yun-fa and other residents of Min-chung village of that District heard the noise of an airplane flying from south-east toward north-west. The Kan-nan Hsien government received on April 4th information from Air Observer Corps that an American airplane invaded that District at 11:30 p.m.

In the morning of April 5th, voles of a single variety were found throughout thirty-one of the forty-five settlements (t'un) of Min-chung, Kung-nung, Hsin-min, Kung-yi, four villages of the Tenth District. Seven hundred and seventeen voles were found altogether, mostly at Kung-nung and Min-chung Village (Document M-8). The places where they were found were fields, ponds, roofs, inside and around houses, vegetable storage pits and wells. The details are given in Table I and II.

TABLE I.—STATISTICAL DATA ON THE DISCOVERY OF VOLES IN THE TENTH DISTRICT OF KAN-NAN HSIEN

Names of Villages	No. of Lüs*	No. of Lüs where voles were discovered	No. of Settlements	No. of Settlements where Voles were discovered	No. of Families where Voles were discovered	No. of Voles
Min Chung	8	7	10	8	31	254
Kung Nung	8	7	15	11	34	244
Hsin Min	6	5	9	5	18	112
Kung Yi	8	5	11	7	17	107
Total	30	24	45	31	100	717

*Lü is equivalent to hamlet

TABLE II.—THE PLACES OF DISCOVERY OF VOLES IN THE TENTH DISTRICT OF KAN-NAN HSIEN

Places / Names of Villages	Inside the House*	In or near the Court Yard	On Roof Top	Inside the Well	In the Field	Others‡	Total
Min Chung	160	65		1	22	6	254
Kung Nung	185	52	7†				244
Hsin Min	99	5	7	1			112
Kung Yi	88	3				16	107
Total	532	125	14	2	22	22	717

Note: * Those found inside houses were moved in by cats.
† The 7 found on the roof in Kung Nung Village includes 5 found on top of a haystack.
‡ The item "Others" includes ponds and vegetable storage pits, etc.

These voles were generally about 10 cm. long, with short tails, greyish black back and light grey belly. Most of them were dead, while those which were still living were found to be sluggish in movements or with fractured legs. One of them has just dug a hole in the field. The hole was about 10 cm. deep, without excreta or stored foods. These voles were identified by Chi Shu-li, plague specialist and Hsia Wu-p'ing, specialist in rodents as being different from the local forms.

On receiving the reports about this incident the Northeastern People's Government and Heilungchiang Provincial Health Administration sent epidemic prevention forces to the spot to carry out preventive measures. Chang Chieh-fan and Chi Shu-li, experts in plague prevention, were also despatched to investigate the matter (Document M-1).

Chang and Chi arrived at the Tenth District of Kan-nan on April 8th and 9th respectively. At that time the people there had already burned most of the voles found since April 5th and buried the remains deeply under the earth. A mobile laboratory unit of the epidemic prevention forces only received and examined four of the voles dropped by the American airplane (collected by district chief Nieh from the 4th Lü of Min-chung Village on April 5th). Fleas were not found. One of the voles which died about one day before was autopsied and was examined bacteriologically. The other three had already putrefied and were used only for zoological identification. They were identified as belonging to the genus *Microtus*. Chang and Chi interviewed many local residents and responsible persons and conducted investigation on many places where voles had been found. They were able to verify the findings as reported by the inhabitants and local governments (Document M-2). In the few

days prior to their arrival, the local residents had caught all these voles, and therefore, no more were noted during their four days' stay in that district.

During the period between April 8th and 12th, Drs. Chang and Chi organized members of the local home guards to make further search of the settlements for these voles. They searched into four haystacks, and caught only 24 house mice (*Mus wagneri*). 150 traps set up in houses and around haystacks in Min-chung Village have caught only 2 sewer rats (*Rattus norvegicus*) and 4 mice. In Kung-yi Village and its neighbourhood 150 traps were set up, which caught 2 rats and five mice. None of them was similar to the voles mentioned above (Document M-2).

After the discovery of voles at Kan-nan, an epidemic prevention unit was organized by Heilungchiang Provincial Government and sent to that district to take preventive measures (Document M-1). Although they could not find any human case of plague through a general health examination of all the people in the villages, they, nevertheless, immediately threw traffic cordon around the areas in which voles had been found. At the same time, members of the epidemic prevention unit conducted extensive disinfection with lysol, flea extermination with DDT, and rat eradication with arsenite in the four villages. The public was mobilized on the one hand to improve their sanitation, and on the other to carry out the work of trapping rats, patching up walls, pits and floors, and scorching rooms to exterminate fleas. Through the efforts of the epidemic prevention unit and the people, a great success was achieved in the prevention of an outbreak of plague.

II. *Zoological Identification*

In order to investigate the source of these voles, the Health Administration had asked Dr. Chi Shu-li and specialist Hsia Wu-ping to conduct a zoological identification (Document M-3). The results of their work are given below:

(1) Material: received on April 10th three of the four voles collected by inhabitants at Min-chung Village of the Tenth District, Kan-nan Hsien, and the skull of one of the buried voles.

(2) Results of identification:

1. Tail rather short, little longer than that of hind foot; tail 17-21 mm., hind foot 15-18 mm.

2. Pelage dark brown, on the back, consisting of hairs with dark gray base and yellowish brown tip. Ventral side is paler in coloration, hair tip slightly yellowish brown and the base also dark gray. Dorsal surface of the tail has same color as the back, and is pale yellow below.

3. Limbs short and slender; claws of normal length, the surface of hind feet clothed with hairs, up to plantar pads which are six in number.

4. Skull narrow and slender, interorbital width small measuring only 2.6-2.8 mm., inter-orbital region with sharp dorsal ridge. Posterior end of palate terminates in a median ridge thus forming two lateral pits. Enamel of last lower molar not formed into a triangle.

According to their morphology these voles were identified as belonging to the Family *Microtinae,* Genus *Microtus.* It is not yet possible to identify into species.

(3) Differentiation from other species of voles of Northeast China: Although Sowerby (16) (17), Mori (13) (14) and Loukashkin (12) have recorded voles from Northeast China, it was only until 1941 that Tokuda (18) published a more complete record, describing 6 species of voles in Northeast China. There has been no further record since 1941. The six species described by Tokuda are:

1. *Lasiopodomys brandti* (Radde) (=*M. brandti*)
2. *Microtus mongolicus* (Radde)
3. *M. obscurus* (Eversmann)
4. *M. pelliceus* Thomas
5. *M.* (*Stenocranius*) *gregalis* (Pallas)
6. *Lemmimicrotus mandarinus mandarinus* (*M.E.*) (=*M. m. mandarinus*)

Among these species only *M.* (*Stenocranius*) *gregalis* Pallas is most closely related to the voles newly discovered in Kan-nan Hsien. Since *M. gregalis* occurs in Inner Mongolia, North China and west part of NE China, it might conceivably appear naturally at Kan-nan. But the voles discovered at Kan-nan are distinguishable from *M. gregalis* by the following characteristics (see Document M-3):

(The data for *M. gregalis* are based on Tokuda's record of the measurements of three specimens one of which is kept in Harbin Museum, and on another well preserved specimen kept also in the same museum, i.e., a total of four specimens.)

a) The tail is shorter. The tail of *M. gregalis* measures about one and half times the length of its foot, and about one fourth the total length of its head and body. However, the tail of the vole newly discovered at Kan-Nan is distinctly shorter, almost as the length of its foot.

b) The inter-orbital is wider.

c) The dental form of these voles differs from that of *M. gregalis*. The triangle of each tooth is larger, and there is no prominent depression on the anterior surface of its first lower molar.

d) The diastema is greater than that of *M. gregalis*.

According to these observations we consider that the morphology of the vole (*Microtus* sp.) newly discovered at Kan-Nan is distinguishable from the local forms of Northeast China. Nor has it been recorded in the literature so far available to us. Determination of the specific name of these voles is now in progress.*

III. *Bacteriological Examinations*

For the purpose of finding out whether these voles carried pathogenic microorganisms, bacteriologist T'sui Chi-sheng and plague specialist Chi Shu-li have made bacteriological examinations. The results are given below (Documents M-5 and M-6) :

(1) Material examined: One of the four voles collected on April 5th at the 4th Lü of Min-chung Village by District chief Nieh. The specimen was received on April 10th, 1952, by Miss Chou of the mobile laboratory.

(2) Procedures: No unusual findings were observed on external examination of the vole. On autopsy the viscera were found to be slightly putrefied, with a dirty dark red color. Smears were made from the spleen and liver of the vole. Pieces of these organs were ground up and made into an emulsion, 0.3 ml. of which was injected subcutaneously into a white mouse and 0.5 ml. into an albino rat by the same route. Examination of the smears revealed Gram-negative bipolar staining small bacilli.

The mouse died 2 days after the injection. On autopsy, the liver and the spleen were found to be slightly enlarged, with congestion. Smears of these organs showed numerous bipolar staining Gram negative bacilli under microscope. Plain agar plates inoculated with spleen and liver materials yielded only coliform growths.

The albino rat died four days after the injection. On autopsy, the liver and spleen were found to be enlarged, with congestion. Stained smears of these organs showed also numerous bipolar staining Gram negative bacilli under microscope. Plain agar plate culture made with the liver and spleen showed confluent growth and colonies of coliform bacilli. Among the coliform growths, there were two colonies resembling that of plague bacilli, partially overgrown by coliform bacteria. An

*NOTE ADDED BY THE COMMISSION
The material concerning the comparative anatomy of the voles was later rewritten and completed by the Chinese scientists following the discussions with the Commission on July 17. It will be found in Appendix O.

attempt of isolating the plague-like colonies for pure cultures was unsuccessful.

The pure culture obtained from the coliform colony was motile, produced indol, and fermented the following carbohydrates with acid and gas production in 24 hours: glucose, galactose, maltose, sorbitol, mannitol, sucrose, lactose, rhamnose, arabinose and xylose. It was therefore identified as belonging to the colon bacillus group.

Pieces of the liver and spleen taken from the autopsied rat were ground up and made into an emulsion, 0.5 ml. of which was injected subcutaneously into another albino rat. The rat died four days after the injection. On autopsy, the liver and spleen were found to be enlarged, with congestion. Infiltration was found at the site of inoculation. The inguinal lymph nodes were enlarged to the size of a soyabean, with adhesion, infiltration, hemorrhage and congestion. Smears of liver, spleen, lymph nodes and heart blood all showed numerous bipolar staining Gram negative bacilli. Plain agar plate inoculated with autopsy material showed numerous colonies of coliform bacilli, among which were 4 colonies resembling that of *P. pestis*. Two of them were nearly completely overgrown by coliforms. From the other two colonies which were not overgrown, pure culture was obtained by fishing and streaking on a fresh agar plate. The following experiments were carried out on this pure culture.

(3) Identification of the isolated pure culture:

(a) General characteristics:

(i) Examination of stained smears showed Gram negative small bacilli. Smears made from animal materials showed prominent bipolar staining, but in smears made from pure culture the bipolar character was not very prominent.

(ii) Non-motile when observed under the microscope in hanging drops.

(iii) Bouillon tube after incubation at 26°C for 48 hours showed no turbidity but flocculent and granular growth at the bottom of the tube.

(iv) On both the plain agar plate and the agar plate containing 0.25% sodium sulphite which were incubated at 26°C for 48 hours and 24 hours respectively, there grew a kind of small colonies, each measuring less than 1 mm. in diameter. They were grayish white under reflected light, and bluish gray and translucent against transmitted light. When examined under the microscope at a magnification of 100 x, the central part of the colonies appeared to be slightly raised with a dark granular

surface, while the edge showed irregular peripheral extensions, a typical appearance of colonies of plague bacilli (*Pasteurella pestis*).

(b) Biochemical properties:

(i) No indol production in 1% peptone water after 48 hours incubation at 26° C.

(ii) No haemolysis on 10% blood agar plates after 96 hours incubation at 26° C.

(iii) No growth on Bessonova acid agar (prepared by adding 3% agar to physiological saline, and adjusting the pH to 6.1) after 96 hours incubation at 26° C.

(iv) Fermentation reactions (all tubes were incubated at 26° C and observed for 96 hours).

Sugars not fermented: rhamnose, lactose, sucrose and sorbitol.

Sugars fermented with acid production but no gas: glucose, maltose, galactose, arabinose (all became acid in 48 hours) glycerine (became acid after 72 hours).

(c) Pathogenicity tests:

One loopful of the growth of the isolated pure culture was suspended in 2.0 ml. of physiological saline. The resulting suspension was injected subcutaneously into 2 white mice, an albino rat and a guinea pig, each animal receiving 0.3 ml., 0.5 ml. and 0.5 ml. respectively. The guinea pig and the rat died three days later and the mice died in two days. On autopsy, the guinea pig showed most marked changes, viz., infiltration, congestion and haemorrhage at the site of inoculation; enlargement of the liver and spleen with dull rounded edges, the surface of these organs were dark red in colour; and there were numerous yellowish white granules of the size of a pin-point in these organs.

Numerous bipolar staining Gram-negative bacilli were found in all the smears made with liver, spleen, lymph node, heart blood and exudate at the sites of injection of all the inoculated animals. Plain agar plates and 0.25% sodium sulphite agar plates inoculated with the liver and spleen of the injected guinea pig and albino rat all grew colonies typical of plague bacillus.

(d) Bacteriophage susceptibility test:

Methods of test:

(i) A drop of the plague phage preparation was put near the periphery of a plain agar plate freshly inoculated with the isolated culture. The drop was allowed to flow downward over the streak at right angle. The plate was incubated at 26° C.

(ii) A drop of the phage preparation was added to a tube of bouillon freshly inoculated with a pure culture of the isolated organism. As a control, another tube of bouillon was inoculated with the same culture and no phage was added.

Results: After 48 hours of incubation at 26° C, on the agar plate there appeared a zone of lysis in the area over which the drop of phage had flowed. In the bouillon culture to which a drop of phage had been added, there was no growth, while in the control tube there was a typical growth of plague bacilli in the form of a granular sediment.

(4) Differentiation from other *Pasteurellae*:

The general characteristics, biochemical properties, pathogenicity tests, and bacteriophage susceptibility test verified that the isolated bacteria were *Pasteurella pestis* (10, 11, 19, 20). This culture was differentiated from *Pasteurella multocida* by the inability to produce indol, by the formation of colonies with typical peripheral extensions on agar plates, by the failure to produce turbidity in bouillon and by the susceptibility to specific plague phage. (10, 19, 20).

This culture was differentiated from the *Pasteurella haemolytica* by the inability to produce hemolysis on blood agar plates. (10, 19).

The facts that it does not ferment rhamnose and sorbitol, that it is lysed by specific plague phage, that it does not grow on Bessonova's acid agar and that it is pathogenic for albino rats make it plain that the microorganism isolated is not *Pasteurella pseudotuberculosis*. (10, 11, 19, 20).

(5) Conclusion: The above examinations and differentiations prove that the organism isolated from the voles received from the Tenth District of Kan-nan Hsien is *Pasteurella pestis.*

IV. *Discussion*

The following facts lead inevitably to the conclusion that the voles discovered in the Tenth District, Kan-nan Hsien, Heilungchiang Province were dropped there by the American airplane.

1) The circumstances under which the voles were discovered were unusual. The people in the Tenth District, on the 4th of April, had been searching in and out of courtyards and around villages for insects. At that time no voles were discovered. But at midnight, an American airplane flew over the district. The next morning, in four villages, seven hundred and seventeen voles were suddenly discovered, most of which were dead, wounded or sick. Such a sudden appearance is most abnormal.

2) The discovered voles were identified by experts to be one kind of voles belonging to the Genus *Microtus*. This kind of rodent was never

known by the villagers. The sudden appearance of these voles in large numbers is definitely not a natural phenomenon.

3) The locality where the voles were discovered was unusual. Members of the subfamily *Microtinae* are wild animals. They do not inhabit villages. According to Sowerby (17a), "All are inhabitants of wild uncultivated areas, different forms occurring in different type of country including forests, brush-covered hills, open grassy hills and mountain sides, meadows and reed-beds". The appearance of these voles in large numbers inside villages is again definitely not a natural phenomenon.

Allen (9), describing the habits of *Microtinae*, said, "In this group, which includes the voles and lemmings, nearly all are essentially ground-living in habits, making runways in swamps and meadows, some species tunneling along the ground and at shallow depth." Although this point agrees with our discovery of the newly dug hole in the field in Kan-nan, this type of voles should not have been found naturally in large numbers inside villages.

4) These voles were discovered in the wrong season. They appeared at Kan-nan on April 5th. At this time of the year, the snow and ice in Hei-lung-chiang Province would just be beginning to melt. According to reports the average temperature at the beginning of April in Kan-nan was 6.4° C. At such a season, the movements and reproduction of voles would, at most, just be beginning. So the sudden discovery of large numbers at such a season is abnormal.

5) Concerning the number of voles discovered, it should be pointed out that although 6 different species of voles were known to occur in Northeast China, the number, however, was small. For instance, in 1949, at 3 places, Tung-liao, Kai-lu and Tung-ke-chung-ch'i, a total of 12,717 rodents were captured, of which only 32 belonged to the genus *Microtus* (3*). This illustrates the impossibility of the sudden natural appearance of voles of this kind in large numbers in Northeast China.

From the above reasons, we reiterate that these voles were dropped by the American airplane.

We affirm further that the purpose of dropping these voles by the American airplane was to spread plague. The evidence may be summarized as follows:

1. From one of the four voles collected, plague bacilli (*Pasteurella pestis*) were isolated. By a series of tests they were well differentiated from other members of the *Pasteurella* group.

2. These voles were not infected naturally with plague. According to previous studies, only three species of rodents are known to be import-

* In this reference, *Microtus* was called "social rats".

ant carriers of plague in Northeast China, namely, the sewer rat (*Rattus norvegicus*), the ground squirrel (*Citellus dauricus*) and the mouse (*Mus wagneri*) (1, 3a, 4). The voles were never found to be naturally infected with plague.

In the history, Kan-nan had never known plague. In Northeast China, during pneumonic plague epidemics of the years 1910 to 1911 and 1920 to 1921 the disease never reached Kan-nan (2, 8, 15). Furthermore, since 1928 the whole of the northern part of Northeast China has been entirely free from plague (3b, 4a, 5, 7). In such a long period of time, if plague were present among the rodents, it would have been impossible for this disease not to appear among the human population. It is therefore evident that the plague infection of the voles discovered in Kan-nan is definitely not a natural one.

3. Could these voles have migrated from some infected area? This also is not possible. Because, firstly, the nearest areas in Northeast China that had plague in men and rodents in the past years, such as An-kwang, Chen-tung, Pai-ch'eng and Wu-lan-hao-t'e, are at least 300 kilometers from the 10th District of Kan-nan Hsien. Secondly, the place that at one time had only human pneumonic plague (T'ai-lai Hsien is still over 150 kilometers from this place. And in T'ai-lai, plague carrying rodents were never found (6). Therefore, we believe that these plague-ridden voles could not have migrated to Kan-nan from other places. Moreover, the communications between these places are not simple. From the east, the river Nun has to be crossed twice and from the west 6 rivers must be crossed. Therefore, there is no possibility of the voles having migrated from other places.

4. The seasonal incidence of plague epidemics in the west part of Northeast China is as follows: Among rodents, it was from the end of April or beginning of May to September or October. Among men, it was from the end of May or from early June to end of October (Document M-7). The plague-ridden voles were discovered on April 5th at Kan-nan, which is located in the northern part of Northeast China. This is not in accordance with the natural seasonal incidence of plague in Northeast China.

From the above reasons, we reaffirm that the voles discovered in the Tenth District of Kan-nan, infected with plague bacilli, were certainly dropped by the American airplane for the purpose of spreading plague.

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DOCUMENT M-1

ORDERS AND REPORTS FROM VARIOUS RANKS OF GOVERNMENTAL OFFICES

Orders from the Ministry of Health, Northeast China People's Government

April 6, 1952

To: Health Administration of Heilungchiang Province and Institute of Plague Prevention of Northeast China.

Re: To strengthen the anti-epidemic work in the district in Kan-Nan where dead voles were found.

Your telephone reports of April 5 and 6 were acknowledged. The number of dead voles dropped by the American airplane in the Tenth District of Kan-nan of your province was so large, and the area of contamination was so wide that due attention must be paid to it. Besides the orders given to you on the telephone, which should be followed, the following is to further clarify your responsibility in the anti-epidemic work in that district.

I. Anti-epidemic work should be strengthened for the prevention of an outbreak of epidemic.

1. The anti-epidemic unit of your province should immediately send a team to the spot. The team should assist the local Health Administration to carry out publicity and educational program and to arouse the mass to improve sanitation and personal hygiene. The team must accomplish the work of rodent trapping and of exterminating rats, mice and fleas with chemicals and of anti-plague inoculations, health examinations, isolation and medical treatment in the whole district.

2. On the basis of their past sanitary condition, the people of that district are required to accomplish within a short period the work of patching up houses, stuffing up holes, and extinguishing fleas, rats and mice. They should also turn over haystacks, remove manure and cleanse animal quarters, toilets, ponds, wells, storerooms, mills, etc., and cats and dogs must be put under effective control, in order to prevent the hiding, multiplication, transmission and spreading of fleas.

3. In villages and settlements, where dead voles were found, public health personnel should be responsible for the eradication of rats and

mice with rat-poisons, exterminating fleas with D.D.T. and disinfection with lysol, so as to prevent an outbreak of epidemic. If necessary, the district involved should be put under traffic cordon so as to prevent a possible spreading.

4. The people should be immediately organized to take inoculations of freeze-dried live plague vaccine prepared from an avirulent strain. All the people of the whole district should be inoculated in a short period.

5. The public health personnel and the basic health organization should, within a certain period, carry on daily rotating medical examinations on the inhabitants for the early discovery, early isolation and early treatment of possible cases of plague.

II. Further investigation is to be conducted in order to gain a thorough understanding of the situation.

It has been decided that Dr. Chang Chieh-fan, Vice Director of the Institute of Plague Prevention of Northeast China, is to start to-day for the spot to investigate the actual situation, and to direct the anti--epidemic work there. Dr. Chi Shu-li of the same institute is to organize a mobile laboratory unit and rush to the spot to collect materials and make examinations in order to determine the pathogenic organism carried.

The above decisions should be passed on to your subordinate organizations and to be strictly enforced.

Minister, Wang Pin
Vice Minister, Tai Cheng-hua
Pai Hsi-ch'ing

Orders from the Health Administration, Heilungchiang People's Government,

April 7, 1952

To: The People's Government and Division of Health of Kan-nan Hsien.

Re: To carry out the anti-epidemic work in the district in Kan-nan where dead voles were found.

An order, "To strengthen anti-epidemic work in the district with dead voles in Kan-nan", from the Ministry of Health of Northeast China People's Government has just been received. According to the order and considering the serious situation that seven hundred and seventeen voles

were discovered in Kan-nan, the following anti-epidemic program was decided.

1. A team from the Provincial Anti-epidemic Station has been sent to the spot to assist you in anti-epidemic work. You are requested to work together for the completion of the work.

2. To carry out effectively mass education, explaining the dangers of plague transmission by fleas and rodents, and giving relevent knowledge about the prevention of an epidemic.

3. To mobilize and organize the people to bring on an anti-rodent and anti-flea movement. The people are required on the basis of previous satisfactory sanitary condition to accomplish within seven days the following: to patch up houses, exterminate fleas, stuff up holes, kill rats and mice, turn over haystacks, remove manure; to cleanse toilets, animal quarters, chicken houses, duck houses, ponds, sinks, wells, storerooms, mills, etc.; and to put cats and dogs under effective control in order to prevent hiding, multiplication, transmission and spreading of fleas.

4. The public health personnel of Min-chung, Kung-nung, Hsin-min and Kung-yi villages of the Tenth District should be responsible for killing rats and mice with arsenite baits, exterminating fleas with 5% D.D.T. powders and disinfecting with 5% lysol the places where dead voles were found, so as to prevent a possible outbreak and spreading of an epidemic. If necessary the district involved may be put under traffic cordon. However, the District Government should see that the necessities of the inhabitants in this district are properly supplied.

5. The people in the entire district should be immediately organised to receive inoculations of freeze-dried live plague vaccine. The Provincial Anti-Plague Station shall supply the vaccine and disinfectants.

6. Within a short period the health auxiliaries should call on the inhabitants every morning and evening. They should report immediately any case of high fever. The public health personnel should carry on daily rotating medical examinations for early discovery, early isolation and early treatment of possible cases of plague.

7. To ensure the completion of this work the administration would send inspectors from time to time. It is hoped that you would also send persons to the district to give assistance and supervision. Also your frequent report on the work is requested.

Administrator,	Liu Kan-ju
First Vice Administrator,	Chin Tsai
Second Vice Administrator,	Hao Pi-ch'ing

Order from the People's Government of Kan-nan Hsien

April 7, 1952

To: The People's Government of the Tenth District.

Re: To carry out effective anti-epidemic work in the Tenth District.

Orders from the Health Administration of Heilungchiang Province have been received, containing the following instructions:

"1. A team from the Provincial Anti-Epidemic Station has been sent to the spot to assist you in anti-epidemic work. You are requested to work together for the completion of the work.

"2. To carry out effectively mass education, explaining the dangers of plague transmission by fleas and rodents and giving relevant knowledge about the prevention of an epidemic.

"3. To mobilize and organize the people to bring on an anti-rodent and anti-flea movement. The people are required on the basis of their previous satisfactory sanitary condition to accomplish within seven days the following: to patch up houses, exterminate fleas, stuff up holes, kill rats and mice, turn over haystacks, remove manure; to cleanse toilets, animal quarters, chicken houses, duck houses, ponds, sinks, wells, store-rooms, mills, etc., and to put cats and dogs under effective control in order to prevent the hiding, multiplication, transmission and spreading of fleas.

"4. The public health personnel of Min-chung, Kung-nung, Hsin-min and Kung-yi villages of the Tenth District should be responsible for killing rats and mice with arsenite baits, exterminating fleas with 5% D.D.T. powders and disinfecting with 5% lysol the places where dead voles were found, so as to prevent a possible outbreak and spreading of an epidemic. If necessary the district involved may be put under traffic cordon. However the District Government should see that the necessities of the inhabitants in this district are properly supplied.

"5. The people in the entire district should be immediately organised to receive inoculations of freeze-dried live plague vaccine. The Provincial Anti-Plague Station shall supply the vaccine and disinfectants.

"6. Within a certain period the health auxiliaries should call on the inhabitants every morning and evening. They should report immediately any case of high fever. The public health personnel should carry on daily rotating medical examinations for early discovery, early isolation and early treatment of possible cases of plague.

"7. To ensure the completion of this work the Administration would send inspectors from time to time. It is hoped that you would also send

persons to the district to give assistance and supervision. Also your frequent report on the work is requested."

On this account, cadres of the villages and settlements should be called together to study the order carefully and to enforce it strictly.

Acting Magistrate, Wu Hsi-p'ing.

April 16, 1952

Minister Wang,
Vice Ministers Tai and Pai,

The enclosed are the reports from magistrate Wu of Kan-nan Hsien of this province. Your opinions on them are requested.

Administrator,	Liu Kan-ju
First Vice Administrator,	Chin Tsai
Second Vice Administrator,	Hao Pi-ch'ing.

April 15, 1952

Chairmen Yü and Wang,

After the discovery of numerous dead voles in the Tenth District of this County, I have received orders by phone and in written statements and was told to report on the work. I have been in the affected villages to look into the matter. The responsible persons of the Tenth District have carried on the anti-epidemic work fairly smoothly and satisfactorily. The dead voles were dealt with and a traffic cordon was thrown immediately. The people flamed and patched up their houses, and improved their environmental sanitation. The anti-epidemic team carried out health examinations, disinfection, baiting of rodents, extermination of fleas, and bacteriological examinations. Prophylactic inoculation in the whole district was completed by April 14th. No human case of plague has appeared up to the present. The traffic cordon of that district has been lifted to-day. People of the anti-epidemic team are still remaining in the involved villages and settlements to continue anti-epidemic work and keep vigilance over the development of the situation. As have been reported in the telephone, I have received from the Chief of the Tenth District a report on the anti-epidemic work, which is now enclosed in this letter. Your further instruction is awaited.

With respect,

Wu Hsi-p'ing,
Acting Magistrate,
Kan-nan Hsien.

April 15th, 1952

Magistrate Wu,

Since the discovery of voles in our District on April 5th, 1952, we have, following your order, taken strict anti-epidemic measures till the present, when most of the work has been completed. The members of the anti-epidemic unit are still continuing their work of improving environmental sanitation and watching the possible occurrence of human cases in the settlements where dead voles were found. A report on the preventive work within the recent period is given below:

1. On April 5th, the Provincial Health Administration sent us 11 anti-epidemic personnel and on April 6th, the same office sent us in addition an epidemic unit consisting of 35 members led by Mr. Liu, head of the unit, making a total of 46 persons. On April 9th there arrived again a group of laboratory personnel. All of them have been engaged in various preventive measures in the settlements where dead voles were found. The militia-men were mobilized to throw traffic cordon on these areas, being effective from April 5th through 15th. Since no human case has been found within this period, the traffic cordon was lifted on 15th following order from your office.

2. The public had been aroused to patch up the walls and floors in their rooms. Special attention was paid to the villages and settlements where voles were found, but the same work was also carried out in other villages and settlements; there are totally 2,382 rooms in this District. All the rooms in the four villages where the American airplane had dropped voles were patched up to such an extent that no clefts or pits were left. (Table 1)

3. D.D.T. was sprayed inside houses and over "kangs" (brick bed); into rat holes, on rat runs, in storerooms, mills and animal quarters. According to Mr. Liu of the Provincial Anti-epidemic Unit, the methods used are as follows:

(1) A 5% dusting mixture was made by thoroughly mixing 10% D.D.T. powders with an equal amount of sieved ash.

(2) Simple bags made of gauze were used to hold and spray the dusting mixture. This is very simple and convenient.

(3) The public was mobilized to move all the mats of "kangs", chests and other belongings to the courtyards, to remove the excreta from animal quarters and to clean the whole houses before spraying. Then, the work of dusting with D.D.T. mixture was accomplished in a rather short time.

(4) Into each of the holes through which rats and mice broke into houses, 5 grams of 5% D.D.T. powder are dispersed by a dust sprayer. Rat poison was put in the holes before they were stuffed with earth.

4. The public had also been aroused to carry out the work of rat and mouse eradication. The holes inside houses were first stuffed as mentioned. In case the holes were again broken by rats, poisonous baits were applied by the anti-epidemic unit to kill them. In addition the indigenous methods of killing rats used by the local inhabitants were also utilized. Some holes had been sprayed and stuffed for three times. At present the houses are devoid of rat holes. The haystacks were overturned by the public to remove hiding places for rats and mice. A total of 204 persons had been mobilized and 134 haystacks overturned. Four hundred and four rodents were killed and buried deeply. Most of those rodents were house mice and there were only a few rats.

5. The inhabitants were inoculated with plague vaccine. This work had been completed for the whole district on April 14th. The population of our district is 8,469, of which 7,148 persons, or 84.4% of the population received the inoculation, people over seventy years, children under five, sick persons and pregnant women being exempted. (Table 2).

6. In general, the environmental sanitary work had been carried out satisfactorily. The houses were cleaned in and out, table utensils boiled, and clothes washed. Covers were put on the latrines. The surrounding ground of wells were raised in order to prevent the accumulation of water around. The wells were also covered and locked up for protection. Wells in which dead vole had been found were exhausted and disinfected before clear water was collected for drinking and other uses. The drainages were dug through and ponds flattened. All the heaps of excreta used as fertilizer were moved outside of the villages.

7. For the sake of preventing an outbreak of plague epidemic, all the cats and dogs in the villages where the American airplane had disseminated plague-carrying voles were sacrificed.

8. As for the public reaction, the inhabitants were excited at the beginning of finding large numbers of dead voles on the morning of April 5th. Since they were educated on this matter and especially when the anti-epidemic unit arrived to carry out various effective preventive measures and no human case had occurred up to now, they had calmed down and continued with the proceeding of the health movement. Their farming work had not been interrupted at all.

Your opinions on this matter will be appreciated.

Nieh Pin, Administrator
10th District, Kan-nan Hsien.

TABLE I:—DATA ON THE PATCHING WORK

April 15th, 1952

Name of Village	No. of Lus	No. of Settlements	No. of Families	Population	No. of Rooms	No. of Rooms patched	Remarks
Min-chung	8	10	275	1,227	298	298	Voles found
Kung-yi	8	11	234	1,103	316½	316½	"
Hsin-min	6	9	235	1,236	340	340	"
Kung-nung	8	15	264	1,245	389	389	"
T'uan-min	9	9	246	1,143	304½	223	
Chun-chung	6	8	218	1,069	291	262	
Min-chu	9	14	335	1,446	443	285	
Total	54	76	1,807	8,469	2,382	2,113½	

TABLE II:—INOCULATION OF PLAGUE VACCINE

April 15th, 1952

Name of Village	No. of Families	Population			No. of inoculated persons	Date inoculated	Remarks
		male	female	total			
Ming-chung	275	672	555	1,227	923	April 7th	Voles found
Kung-yi	234	595	508	1,103	971	" 8th	"
Hsin-min	235	673	563	1,236	1,074	" 8th and 9th	"
Kung-nung	264	701	544	1,245	995	April 9th and 10th	"
Tuan-min	246	604	539	1,143	1,032	April 11th and 12th	
Chun-chung	218	568	501	1,069	879	April 12th and 13th	
Min-chu	335	781	665	1,446	1,274	April 13th and 14th	
Total	1,807	4,594	3,875	8,469	7,148 (84.4% of total population)		

DOCUMENT M-2

A REPORT ON THE INVESTIGATION OF THE DISCOVERY OF VOLES IN THE TENTH DISTRICT OF KAN-NAN HSIEN, HEILUNGCHIANG PROVINCE

By Chang Chieh-fan, M.B., Vice Director,
Institute of Plague Prevention, Northeast China

Reported on April 13th, 1952.

From April 8th to April 12th, 1952, I was at the Tenth District of Kan-nan Hsien for investigating the problem in connection with voles. The results are reported as follows:

1. Duration of Investigation: April 8th to April 12th—5 days.

2. The District where the voles were discovered:

The voles were discovered in four villages of the Tenth District of Kan-nan Hsien, namely Min-chung, Kung-nung, Hsin-min and Kung-yi, forming an area of 15 kilometers from the north to the south and 5 kilometers from the west to the east. Its southern border is adjacent to Yung-chiang Hsien, and its northern border to the villages named Min-chu, Tuan-min and Chün-chung. Its western border is lined by the A-Lun River while its eastern border by Nun River (Nonni River).

3. The discovery of the voles:

(1) The number of voles discovered: Among the fourty-five settlements ("t'un") of Min-chung, Kung-nung, Hsin-min and Kung-yi, four villages of the Tenth District of Kan-nan Hsien, voles were discovered in thirty one. They were mostly discovered at Min-chung and Kung-nung Village and the rest were discovered at Hsin-min and Kung-yi Village. Totally 717 voles were discovered.

Names of Villages	No. of Lüs	No. of Lüs where voles were discovered	No. of Settlements	No. of Settlements where voles were discovered	No. of Families where voles were discovered	No. of voles discovered
Min Chung	8	7	10	8	31	254
Kung Nung	8	7	15	11	34	244
Hsin Min	6	5	9	5	18	112
Kung Yi	8	5	11	7	17	107
Total	30	24	45	31	100	717

(2) The circumstances under which the voles were discovered.

Voles were discovered in the above mentioned villages and settlements in the morning of April 5th. Of these voles 74.2% were discovered on the "Kang" (bed) inside houses and on the ground; 17.4% were discovered in courtyards and their neighbourhood; and 8.4% were found to be scattered on the roof of the house, in the open well and vegetable storage pits, in front of the haystacks, inside the ponds, in the neighbouring field, etc.

Places / Names of Villages	Inside the House	In the Courtyard and neighbourhood	On Roof Top	Inside the Well	In the Field	Others	Total
Min Chung	160	65		1	22	6	254
Kung Nung	185	52	7				244
Hsin Min	99	5	7	1			112
Kung Yi	88	3				16	107
Total	532	125	14	2	22	22	717

For instance:

(a) Wang Yu, an inhabitant of the 3rd "Lü", Min-chung Village discovered 7 voles on his "kang", one vole on the east side of his house and one vole in an open well. Wang Ching-Yun, an inhabitant of the 4th "Lü" found 36 voles on the ground of the outer room and 3 voles inside a vegetable cellar. Tsai Shu-fang, the wife of Po Feng-shan, living in the house of Yang Teh-Kuei of the 6th "Lü" saw 16 voles on her "kang" and one vole in the courtyard (and also saw a cat bringing in three voles one after another into the house). Lin Shu-Fa of the 6th "Lü" discovered 20 voles in front of a haystack. Hsü Chang-chiang of the 7th "Lü" discovered 4 voles on the "kang" and 5 voles south of a horse manger. Shih Chang-shun of the 7th "Lü" discovered 8 voles on the "kang" and 3 voles.

in a store room. Chu Pao-jung of the 8th "Lü" discovered 3 voles on the "kang" and 3 voles in the courtyard.

(b) Wang Yü, an inhabitant in the 1st "Lü" of Kung-nung Village discovered 15 voles on the "kang". Liu Feng-t'sai discovered 2 voles on the roof of a store house, and old Mrs. Wang discovered 10 voles on her "kang". In the second "Lü", Kao Chen-fei discovered 5 voles in a corner of the walls, and in third "Lü", Hu Kwang-teh discovered 15 voles on the stove platform. In the 7th "Lü", Chu You discovered 5 voles on top of a haystack and Chao Ch'eng-teh discovered 5 voles on a heap of grass and 10 near the base of a wall.

(c) In Hsin-min Village, Ch'en Hsüeh-li of the 1st "Lü" discovered 7 voles on the roof of a store room. In the 5th "Lü" Wu Hai-shan found 21 on the "kang" and 5 outside the door, and Tang Wan-you found 22 on the "kang". In the 6th "Lü", Chü Wen-hsiang discovered 4 in a store-room and 2 on the ground of the outer room.

(d) In the Kung-yi Village, Ch'en K'uan of the 2nd "Lü", K'ou Yung-kuei of the 5th "Lü", Tou Chih of the 6th "Lü" and Li Ying-hsien of the 7th "Lü" discovered 9, 6, 2 and 12 voles on their "kang" respectively. In the 8th "Lü" Wu Yung-tsai found 10 on the south "kang" and one on the north "kang".

I have visited and interrogated them house by house. In those where the voles were discovered indoors, there were cats, and there were usually cat holes for their passages. In those houses with holes in between the inner and outer rooms, voles were discovered on their "kang", but in those without such holes voles were only discovered in the outer room.

(3) The appearance of dead vole:

When I arrived at the Tenth District on April 8th, most of the discovered dead voles had been burnt and buried as an emergency measure. On April 10th our anti-epidemic unit started a temporary laboratory and received four specimens of dead voles. According to the District Administrator, one of them was dead just about a day ago. All four voles were about 10 cm. in length with a dark brown back and yellowish brown belly. The length of tail was less than one third of its body length. They were identified by Dr. Chi Shu-li as a kind of vole belonging to the Genus *Microtus* of Family *Microtinae*.

4. Rodents collected by turning over haystacks and trapping:

For a further investigation into the discovery of rodents in that district, I have organized the local militiamen to search around. They turned over four haystacks and caught only 24 house mice (*Mus wagneri*). Fifty traps set up in the rooms of seven houses where dead voles w

found in the 6th "Lü" and 100 traps set up around haystacks in Min-chung Village caught only 2 rats (*Rattus norvegicus*) and 4 mice. In Kungyi Village and its vicinities, 150 traps were also set up in the rooms and around haystacks. Only 2 rats and five mice were caught.

I have also searched for rodent holes in the field around the settlements. Two small new holes were discovered in the field nearby the 6th "Lü" of Min-chung Village, the depth of which was only about 10 cm. No vole, food stuff or excreta were discovered inside.

On inquiring those who had seen the dead voles, they also replied in the same way that they had never seen such kind of voles before. A few of the villagers had seen the living voles. For examples: the three voles discovered in his vegetable storage-pit by Wang Ching-yun in the 4th "Lü" of Min-chung village, the one discovered in the courtyard by Li Chang-ching in the 2nd "Lü" of Kung-nung Village and the two discovered in the store room by Lu Wen-hsien in the 1st "Lü" of Kung Nung Village were all living, but they were sluggish in movement with a limping gait. They were all caught and killed very easily. An inhabitant of the 4th "Lü" of Ming-chung Village, named Yu Hsi-hai, found one vole from a small hole which was less than 10 cm. in depth and contained no foods or excreta inside. All these voles thus discovered were entirely different from the five local forms of rats and mice, namely sewer rat (*Rattus norvegicus*), ground squirrel (*Citellus dauricus*), house mouse (*Mus wagneri*), Mole rat (*Myospalax komurai*) and hamsters (*Cricetulus barabensis*).

5. About the airplane:

A number of the villagers heard the noise of an airplane in the mid-night of April 4, 1952. Chen Wan-fu of the 4th "Lü" of Min-chung Village heard the noise of an airplane flying from southeast toward northwest direction, when he was up to feed his horse. On the next day, voles were discovered in various places. Another person in Min-chung Village who had also heard the noise of an airplane was the aunt of Liu Yun-fu while she was nursing her baby. Other villagers like Liu-fu and the mother of T'ang Wan-you of the 5th "Lü" of Hsin-ming Village, Wang You of the 3rd "Lü" of Min-chung Village, Ma Shu-ying, the wife of Kuo Yu-fang of the 3rd "Lü" of Kung-nung Village, etc., also heard the noise of an airplane in the mid-night of April 4. From the County Government, we learned that the Air-observer Corps had noticed the intrusion of an American airplane into Kan-nan Hsien at 11:30 p.m., April 4, 1952.

6. Preventive measures taken in the District:

(1) At present we have 35 persons in the anti-epidemic unit. On April 10, we established a laboratory. Traffic between the various settlements has been blockaded by militiamen.

(2) Those houses where dead voles were found were disinfected by scorching. Articles in these houses were either sprayed with or soaked in 5% lysol. For safety sake, all the cats and dogs in this district were sacrificed.

(3) 5% D.D.T. powder was sprayed over "kang" and the ground. Every rat hole was sprayed with 5 grams of 5% D.D.T. powder and then stuffed up with earth.

(4) A bait containing 10% arsenite was thrown into those holes reopened by rats.

(5) All the people in the four villages with dead voles have been inoculated against plague and it is planned to inoculate the whole population in this district.

(6) The mass was taught anti-epidemic knowledge. The importance of killing rat and flea extermination is emphasized.

(7) The population was mobilized to improve their environmental sanitation. Every family had cleaned their house and patched up their walls and grounds.

(8) Report system was re-enforced. Any case with high fever or glandular enlargement must be reported to the anti-epidemic unit immediately. The members of the anti-epidemic unit were sent to all the settlements to take rotating medical examinations.

7. Investigation of possible occurrence of human cases.

From April 5, when dead voles were discovered, up to April 12 no case of human plague has occurred so far. According to our investigation, plague has never occurred in Kan-nan Hsien and has never been seen by the old physician in this locality.

8. Conclusion:

In summary, the following facts are noteworthy:

(1) The Air-Observer Corps had noticed the intrusion of an American airplane into Kan-nan Hsien at 11:30 p.m. on April 4, 1952, and the inhabitants there had also heard the noise of the plane.

(2) On the next morning (Apr. 5), seven hundred and seventeen voles were discovered in thirty one settlements. These settlements formed an elongated zone.

(3) Most of dead voles were discovered inside the houses. Evidently they were brought in by cats, because they were found only in those houses where there were cats but not in those without cats. The remainder were

found on roofs, in front and behind houses, by the side of the haystacks, in the courtyards, in open wells, vegetable storage-pits and ponds and in the nearby fields. These dead voles were found to belong to the Genus *Microtus* and should not be discovered inside the villages and settlements in such large numbers. On turning over haystacks and setting up traps, no similar kind of voles was found.

(4) Voles are not natural inhabitants around the settlements.

(5) Those voles which were discovered alive, were sluggish in movement with a limping gait. They seemed to have been injured on falling. The one discovered in the field had dug a hole only about 10 cm. in depth. At that time, it was still freezing in the morning and at night, and the ground has not yet thawed.

(6) The people of this district have never seen this kind of voles, nor have they ever seen dead mice or rats in such large number.

(7) In the past, there has been no plague of any form in Kan-nan Hsien.

From the above facts, it is evident that these voles must have been dropped from the American airplane for the purpose of spreading epidemic diseases.

The result of laboratory examinations of these voles will be submitted in a separate report.

DOCUMENT M-3

REPORT ON ZOOLOGICAL IDENTIFICATION

Source of specimen: Min-chung Village, Tenth District, Kan-nan Hsien, Heilunchiang Province.

Name of specimen: Voles.

Classification: Belong to

Order: Rodentia

Family: Muridae

Subfamily: Microtinae

Genus: *Microtus.*

Morphology:

Length of head and body: 85-100 mm.
Length of tail: 17-21 mm.
Length of hind foot: 15-18 mm.
Length of ear: 8-10 mm.

Pelage: Back as a whole—dark brown (the base of the hair is dark gray while the tip is yellowish brown in color). Abdomen—the tip of hair is yellowish brown but lighter while the base is dark gray in color.

Extremities: The length of claws of the fore limbs is shorter than that of the toes. The posterior surface of the hind leg is covered with fine hairs. There is no hair from plantar pads to toes. The plantar pads are six in number.

Skull: Posterior end of palate terminates in a median ridge thus forming two lateral pits. Inter-orbital width measures 2.6-2.8 mm. Enamel of the third lower molar ($M\bar{3}$) does not form a solitary triangle.

Remarks: This specimen has not been found to be identical with any of the voles in our collection, or with those described in the available literature concerning the rodents of Northeast China. The species of this vole has not yet been identified.

Attached: A table* of measurements of Kan-Nan specimens in comparison wtih those of *Microtus gregalis* quoted from Tokuda.

Reported by:

Hsia Wu-p'ing, B. S.,
Research Assistant, Academia Sinica.

Chi Shu-li, M. B.,
Head, Division of Bacteriology and Division of Zoology,
Institute of Plague Prevention, Northeast China.

Date of report: May 18, 1952.

*This table has been reorganized and included in the table of Appendix O (see p. 275).

DOCUMENT M-4

REPORT ON THE COMPARISON BETWEEN THE VOLES COLLECTED AT KAN-NAN AND MICROTUS GREGALIS (Pallas)

See Appendix O

DOCUMENT M-5

REPORT ON BACTERIOLOGICAL EXAMINATIONS

1. Source of specimen: Min-chung Village, Tenth District, Kan-nan Hsien.
2. Date received: April 10, 1952.
3. Name of specimen: One dead vole. (*Microtus sp.*)
4. Procedures: On autopsy, the visceral organs were found to be slightly putrified. Pieces of the liver and spleen were taken for direct smear, and inoculations were made subcutaneously into a white mouse and an albino rat. After the pure culture had been obtained, the following examinations were carried out:
   (1) General characteristics.
   (2) Biochemical properties.
   (3) Pathogenicity to laboratory animals, especially albino rats.
   (4) Bacteriophage susceptibility test.
5. Results:
   (1) General characteristics:
      (a) Microscopic examination of smears revealed Gram negative small bacilli which showed distinct bipolar staining characteristics on smears made from the animal organs but less distinctly on smears made from the cultures.
      (b) The bacteria were non-motile when examined under the microscope.
      (c) Meat broth culture after incubation at 26° C for 48 hours showed no turbidity but flocculent and granular growth at the bottom of tube.
      (d) In plain agar plate and agar plate containing 0.25% sodium sulphite, incubated at 26° C for 48 and 24 hours respectively, grew a kind of small colonies, each measuring less than 1 mm. in diameter. They were grayish white under reflected light; but bluish gray and translucent against transmitted light. When examined under the microscope at a magnification of 100 x, the central part of the colony was slightly raised, with a dark granular surface. The edge showed an irregular peripheral extension which was typical of the colonies of *Pasteurella pestis*.

(2) Biochemical properties:

(a) No indol production in 1% peptone water after 48 hours incubation at 26° C.

(b) No hemolysis on 10% blood agar plate after 96 hours incubation at 26° C.

(c) No growth on Bessonova acid agar after 96 hours incubation at 26° C.

(d) Fermentation reactions.
Sugars not fermented: rhamnose, lactose, sucrose and sorbitol. Sugars fermented with acid production but no gas: glucose, maltose, galactose, arabinose (all became acid in 48 hours) and glycerine (became acid after 72 hours).

(3) Pathogenicity tests:

One loopful of the growth of the isolated pure culture was suspended in 2.0 ml. of physiological saline. The resulting suspension was injected subcutaneously into 2 white mice, an albino rat and a guinea pig, each animal receiving 0.3 ml., 0.5 ml. and 0.5 ml. respectively. The rat and the guinea pig died in three days and the mice died in 2 days. On autopsy, the guinea pig showed most marked changes, viz: infiltration, congestion and hemorrhage at the site of inoculation; enlargement and congestion of the liver and spleen with dull rounded edges, the surface of these organs being dark red in color, with numerous pin-point sized yellowish white granules.

Numerous bipolar staining Gram-negative bacilli were found in all the smears prepared from liver, spleen, lymph nodes, heart blood and exudate from the site of injection of the inoculated animals. Nutrient agar plates and 0.25 percent sodium sulphite nutrient agar plates inoculated with the liver and spleen of the injected guinea pig and albino rat all grew colonies typical of *Pasteurella pestis.*

(4) Bacteriophage susceptibility test:

(i) A drop of the plague specific phage preparation was put near the periphery of a nutrient agar plate freshly streaked with the isolated culture. The drop was allowed to flow downward over the streakings at a right angle. The plate was incubated in an incubator.

(ii) A drop of the phage preparation was added to a tube of broth freshly inoculated with a pure culture of the isolated organism. As a control, another tube of broth was inoculated with the same culture in which no phage was added.

Results: After 48 hours of incubation at 26 degree C, on the agar plate there appeared a zone of no growth in the area where the drop of phage had flowed over; in the broth culture to which a drop of phage had been added, there was no growth, while in the control tube there was a typical growth of *Pasteurella pestis,* in the form of granular sediments.

6. Conclusion: From the dead vole (*Microtus* sp.), a strain of pathogenic bacteria was isolated, identified as *Pasteurella pestis.*

Reported by

Chi Shu-li, M. B.

Head, Division of Bacteriology and Division of Zoology, Institute of Plague Prevention, Northeast China.

T'sui Chi-sheng, M. B.

Director, Institute of Plague Prevention, Northeast China.

Date of report: May 3, 1952.

DOCUMENT M-6

PROTOCOLS OF BACTERIOLOGICAL EXAMINATION OF THE VOLE COLLECTED FROM KAN-NAN HSIEN

(for reference only)

Material: On April 5, 1952, Nieh Pin, the district administrator of the Tenth District, Kan-nan Hsien, collected four voles from the fourth "Lü" (hamlet) of Min-chung Village. Among the four voles which were sent to us by Miss Chow of the mobile laboratory on April 10, 1952, three were putrefied and could only be used for zoological identification. So only the fourth one which died on April 8th was used for bacteriological examination.

Duration of Examination: From April 10th to May 2nd, 1952.

Procedures and Results:

April 10th: There was no distinct abnormal finding on the body surface. On autopsy, the animal was already slightly putrefied with organs showing a dirty dark red color, but no gross pathological changes were observed.

1. Microscopic examination of smears: On smears made from the liver and spleen, many Gram negative bipolar staining small bacilli were seen. Since the organs were already putrefied, no culture was made.
2. The liver and spleen of the vole were ground and an emulsion prepared, 0.3 ml. of which was injected subcutaneously into a white mouse (No. 1) and 0.5 ml. into an albino rat (No. 1).

April 11th: The white mouse (No. 1) and albino rat (No. 1) inoculated yesterday showed no signs of illness.

April 12th: The white mouse (No. 1) died.

Autopsy: Liver and spleen showed no visible enlargement but congestion on surfaces.

Smear examination: From the liver and spleen numerous small bipolar staining Gram negative bacilli were found. Pieces of the liver and spleen were streaked on two separate plain agar plates.

April 13th: From cultures made yesterday from the liver and spleen of the white mouse (No. 1) grew only coliform colonies. (Cultures incubated at 26° C)

April 14th: There were still only coliform colonies on the cultures made on April 12th from the liver and spleen of the white mouse (No. 1).

The albino rat (No. 1) inoculated on April 10th died.

Autopsy: Liver and spleen enlarged and congested with ecchymosis and hemorrhage. Microscopic examination of smears revealed many small Gram negative bipolar staining bacilli. Cultures were made with two plain agar plates (one for liver and the other for spleen).

April 15th: From the cultures made from the liver and spleen of the albino rat (No. 1) on April 14, also grew coliform colonies.

April 16th: Among the coliform colonies, two suspicious colonies resembling those of plague bacilli were found on the culture plate made with the viscera of the albino rat (No. 1), being partially overgrown by the coliform bacteria.

1. The suspicious colonies were fished out for pure culture.
2. The liver and spleen of the albino rat (No. 1) which died on April 14th were ground up and an emulsion prepared, 0.5 ml. of which was injected subcutaneously into another albino rat (No. 2).

April 17th:

1. From the culture made on April 16th of the suspicious colonies grew only coliform colonies.
2. A pure culture of the coliform bacilli was made.

April 18th: The pure culture showed colonies resembling those of coliform bacteria. A suspension was prepared from the colonies. (1 loopful/ml.) The suspension was then injected subcutaneously into a white mouse (No. 2) and an albino rat (No. 3), using 0.3 ml. and 1.0 ml. respectively.

April 19th: The coliform pure culture (April 18) was used for the following tests:

1. Motility: active movement.
2. Inoculation into 1% peptone water.
3. Sugar fermentation tests:—media containing the following sugars, two tubes of each were inoculated:
   Glucose, galactose, lactose, sorbitol, sucrose, maltose, rhamnose, mannitol, arabinose, and xylose.

April 20th:

1. 1% peptone water—good growth. Indol test positive.
2. Fermentation tests—all produced acid and gas. Therefore, they were confirmed to be colon bacteria.
3. The white mouse (No. 2) inoculated with bacteria suspension on April 18th died. It was autopsied and cultures were made on plain agar plates with spleen and liver separately.
4. The albino rat (No. 2) inoculated on April 16th died.

Autopsy: Liver and spleen enlarged. The surface showed congestion, and hemorrhage. The site of inoculation showed signs of infiltration. The inguinal lymph nodes enlarged to the size of a soy-bean, with adhesion, infiltration, congestion and hemorrhage.

Microscopic examination of the smears: From the liver, spleen, lymph nodes, heart blood and site of injection, numerous Gram negative small bacilli were found.

Isolation cultures were made on two plain agar plates, one for spleen and the other for liver.

April 21st: The isolation culture made with the viscera of the white mouse (No. 2) still showed coliform colonies.

April 22nd: On the isolation cultures made from the liver and spleen of the albino rat (No. 2), there were four colonies resembling those of the *Pasteurella pestis* among the coliform colonies. Two of them were almost completely overgrown by coliforms. The other two colonies which were not overgrown by coliforms, were fished out and transferred to two plain agar plates.

April 24th: From the above culture plates made on April 22nd, pure cultures were obtained. The colonies resembled very much those of the *P. pestis*, each measuring less than 1 mm. in diameter and being granular and translucent in appearance with irregular peripheral extentions. Smear examination revealed Gram negative bacilli. It was then transferred onto two plain agar slants.

April 26th: The pure cultures grew well and the following examinations were then carried out:

1. Semisolid agar, 1.
2. Meat broth, 1.
3. Plain agar plate and 0.25% sodium sulfite agar plate, one each.
4. 1% peptone water, 1.
5. 10% blood agar plate, 1.

6. Bessonova acid agar slant, 1.
7. Glucose, maltose, galactose, arabinose, rhamnose, lactose, glycerine, sucrose and sorbitol, two each.
8. Bacterial suspension (1 loopful in 2 ml.) was prepared and inoculated subcutaneously into the following animals:
   - 2 white mice (No. 3 and 4) subcutaneously 0.3 ml. each.
   - 1 albino rat (No. 4) subcutaneously 0.5 ml.
   - 1 guinea pig (No. 1) subcutaneously 0.5 ml.
   - 1 guinea pig (No. 2) infected through skin.
9. Bacteriophage susceptibility test (using 1 plain agar plate and 1 meat broth.)

April 28th:

1. Semisolid agar: a linear growth along the stab without any branches.
2. Plain agar plate: showed colonies each measuring less than 1 mm. in diameter. The colonies appeared grayish white in color under reflected light, but bluish gray in color and translucent against transmitted light. When examined under the microscope with a magnification of 100 X, the central part was yellowish in color and had a granular surface. The edge was translucent with irregular peripheral extensions.
3. Meat broth: The supernatant fluid remained clear while the lower portion contained granular and flocculent sediment. Microscopic examination showed no motility.
4. Indol reaction negative.
5. No hemolysis on 10% blood agar plate.
6. No growth on Bessonova acid agar medium.
7. Production of acid but no gas in the tubes containing glucose, galactose, arabinose and maltose. No fermentation took place in the tubes containing rhamnose, lactose, sucrose, sorbitol and glycerine.
8. White mice (No. 3 & 4) died. Autopsy revealed typical pathological changes of plague.
9. Plague bacteriophage susceptibility test: The agar showed a prominent zone with no growth and the meat broth was clear. The controls gave good growth—the agar plate showed no zone of lysis and the meat broth showed granular and flocculent sediment.

April 29th:

1. The fermentation tubes showed the same result as on April 28th, except that glycerine began to be hydrolyzed with production of acid but no gas.

2. The guinea pig (No. 1) and albino rat (No. 4) inoculated subcutaneously died.

Autopsy: The site of injection showed infiltration, congestion and hemorrhage. The liver and spleen were enlarged with dull round edges. Their surface appeared dark purple with numerous pin-pointed yellowish granules, more marked in the guinea pig.

Direct smear examination: From the liver, spleen, lymph nodes, heart blood and site of injection, many small Gram negative bipolar staining bacilli were found.

Isolation cultures were made from the liver and spleen of the dead guinea pig (No. 1) and albino rat (No. 4) on a plain agar plate and an agar plate containing 0.25% sodium sulfite.

May 1st:

1. The fermentation tubes remained the same as on previous days.
2. Blood agar plate: No hemolysis.
3. The guinea pig (No. 2) infected through the skin died.

Autopsy revealed typical pathological changes of plague. The spleen and liver were enlarged with congestion, hemorrhage and numerous pin-point yellowish granules on their surfaces. The site of injection showed necrosis and hemorrhage.

4. From both the plain agar plate and that containing 0.25% sodium sulfite inoculated with the spleen and liver of the albino rat (No. 4) and guinea pig (No. 1), typical colonies of *Pasteurella pestis* were obtained.
5. The albino rat (No. 3) injected subcutaneously with the colon bacteria on April 18th was still alive.

May 2nd: Conclusion:

From the vole, *Pasteurella pestis* was isolated.

Examined by

Chi Shu-li, M. B.

Head, Division of Bacteriology and Division of Zoology, Institute of Plague Prevention, Northeast China.

Lu Chuang

Tan Ching-lan,

Checked by

T'sui Chi-sheng, M. B.

Director, Institute of Plague Prevention, Northeast China.

A Summary of the Procedures of the Bacteriological Examination of the Vole Collected from Kan-nan Hsien:

- **Liver & Spleen of the Vole**
  - Direct smear Examination: Bipolar staining small Gram negative bacilli
  - Animal inoculations
    - White mouse (No. 1)
      - Direct smear Examination: Bipolar staining small Gram negative bacilli
      - Isolation culture: coliform bacteria
    - Albino rat (No. 1) (1st passage)
      - Direct smear Examination: Bipolar staining small Gram negative bacilli
      - Isolation culture → coliform colonies → pure culture
        - motility (+)
        - Indol reaction (+)
        - Glucose, lactose, sorbitol, sucrose, xylose, rhamnose, arabinose and galactose all give gas and acid formation after 24 hours.
        - Animal inoculation
          - albino rat (No. 3) → alive
          - white mouse (No. 2) → died → coliform colonies
      - Animal inoculation (2nd passage) (using the liver and spleen of the dead albino rat No. 1); albino rat (No. 2) died → isolation culture → pure culture (**Pasteurella pestis**) → subjected to pure culture studies

- **Pure Culture**
  1. Semiliquid agar medium: linear growth without branches after 24 hours incubation.
  2. Meat broth: The supernatant fluid remained clear while the bottom portion showed granular and flocculent growth 48 hours later.
  3. Plain agar plate............24 hrs.
  4. 0.25% sod. sulfite agar plate..48 hrs.

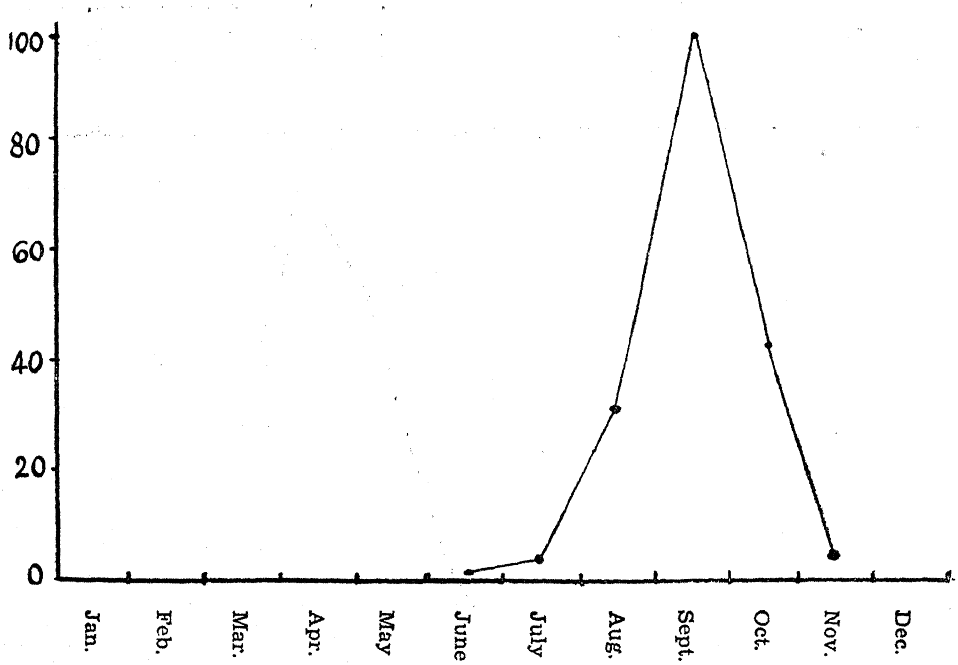
     (3 and 4:) Colonies, each of less than 1 mm. in diameter. Examined under a microscope (100 X), the central portion appeared dark granular on the surface, the edges irregular and translucent with peripheral extension.
  5. 1% peptone water: Indol reaction negative.
  6. 10% blood agar plate: No hemolysis after 96 hours incubation.
  7. Bessonova's acid agar slant—no growth after 96 hours incubation.
  8. Sugar media: Fermented glucose, galactose, arabinose, maltose and glycerine with production of acid but no gas after 96 hours of incubation.

     No fermentation in tubes containing rhamnose, lactose, sucrose and sorbitol.
  9. Animal inoculation
     - subcutaneous
       - white mice (No. 3 & 4) died 2 days later
       - guinea pig (No. 1), albino rat (No. 4): died 3 days later → **Pasteurella pestis** isolated
     - through skin——guinea pig (No. 2)....died 5 days later.
  10. Plague bacteriophage susceptibility test: Both plain agar plate and meat broth → positive.

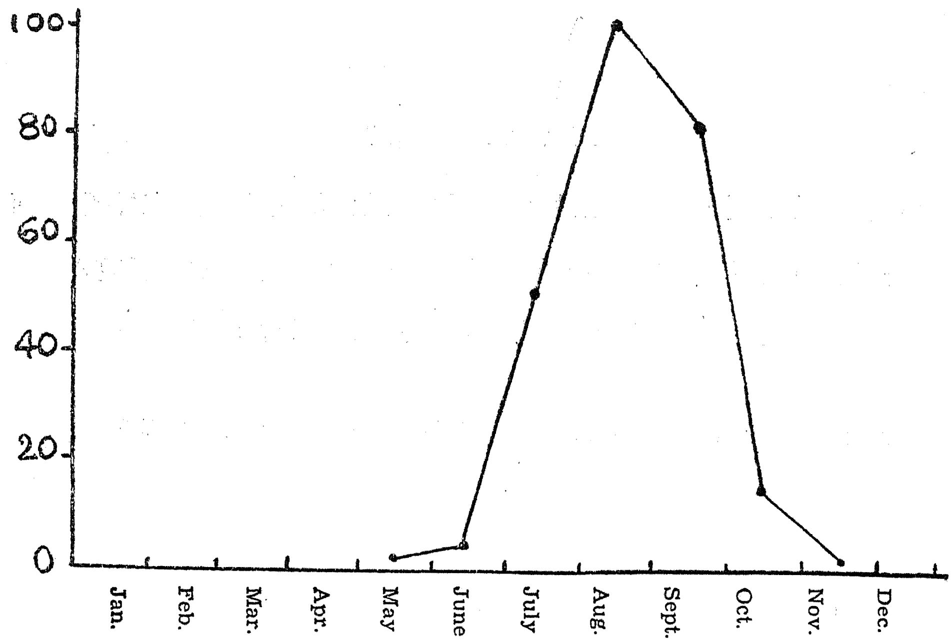
DOCUMENT M-7

STATISTICS OF CASES OF PLAGUE OCCURRING IN DIFFERENT MONTHS IN THE ENDEMIC AREA OF NORTHEAST CHINA, 1947-1951

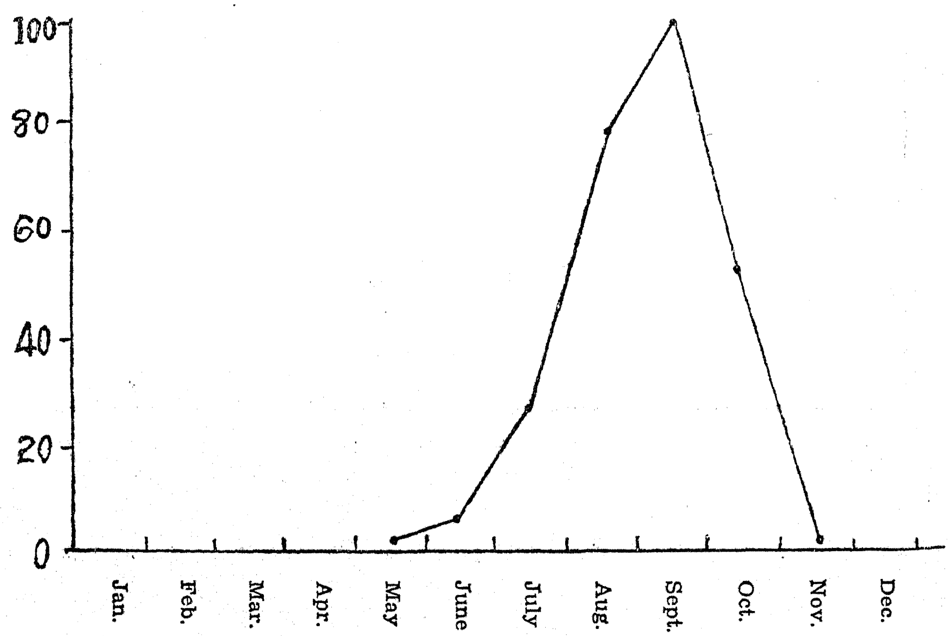
(In percentages, taking the highest incidence as 100%)



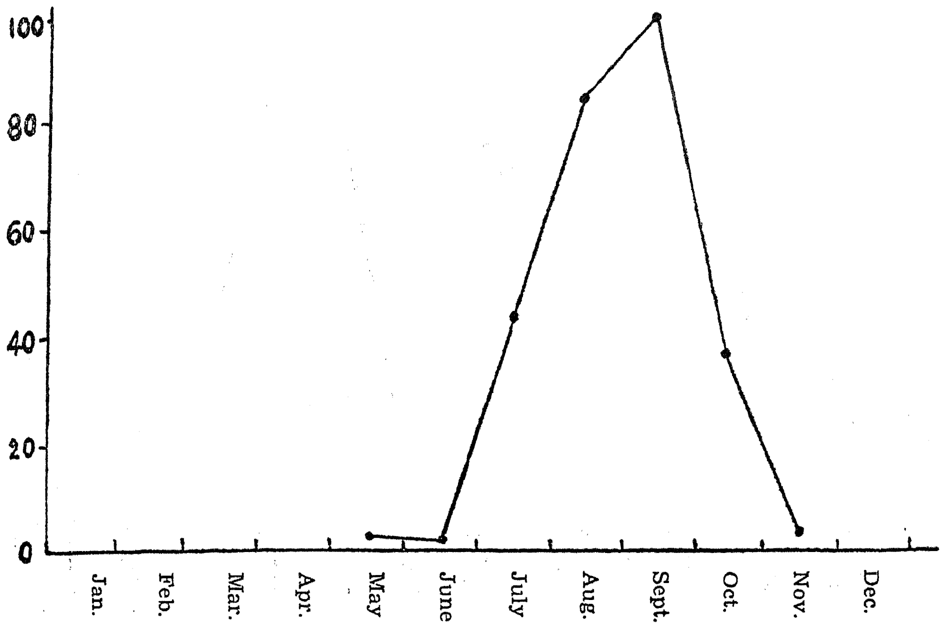
Text Fig. 1. Monthly Distribution of Plague Cases in Endemic Area of Northeast China in 1947.



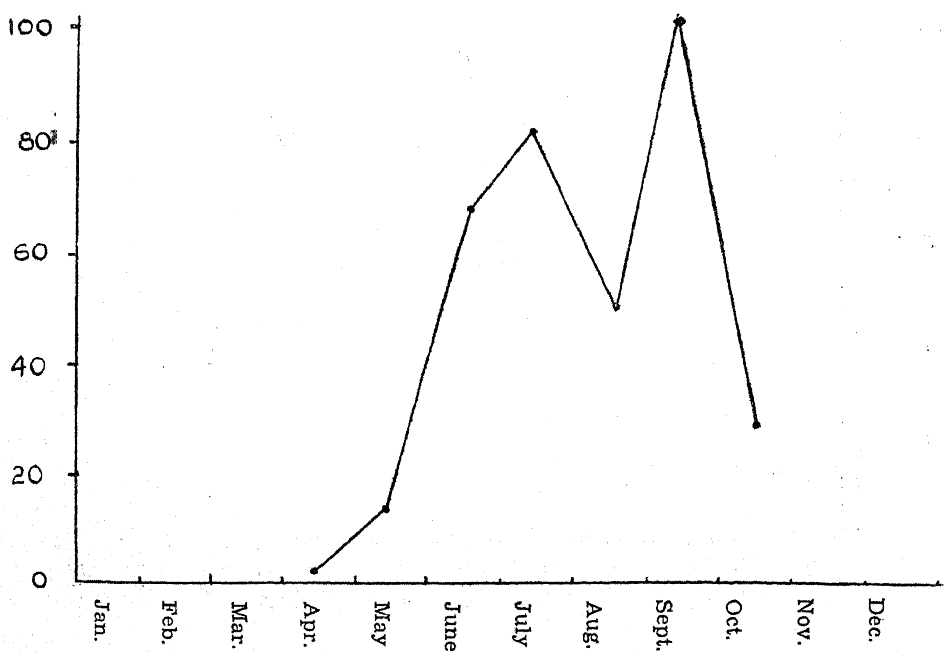
Text Fig. 2. Monthly Distribution of Plague Cases in Endemic Area of Northeast China in 1948.



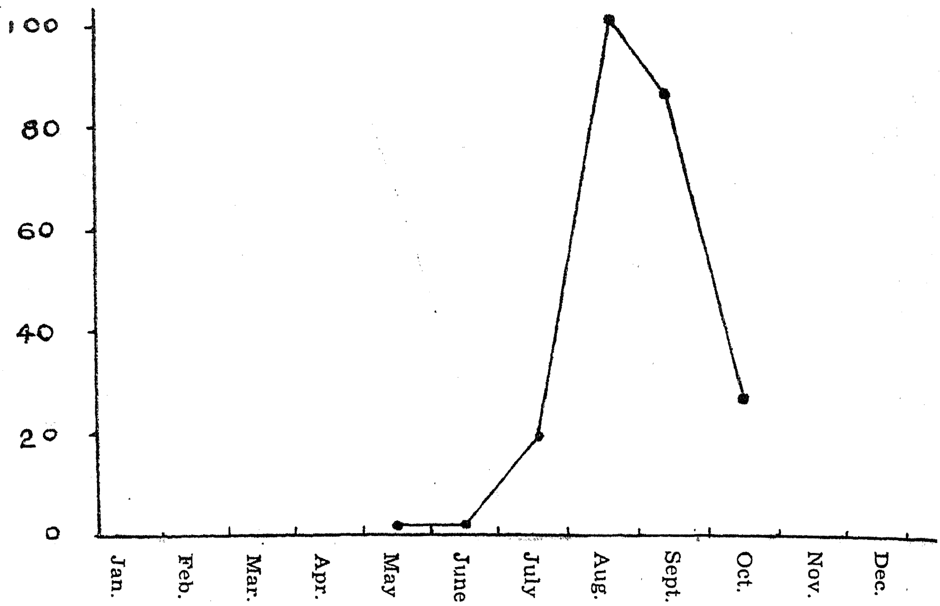
Text Fig. 3. Monthly Distribution of Plague Cases in Endemic Area of Northeast China in 1949.



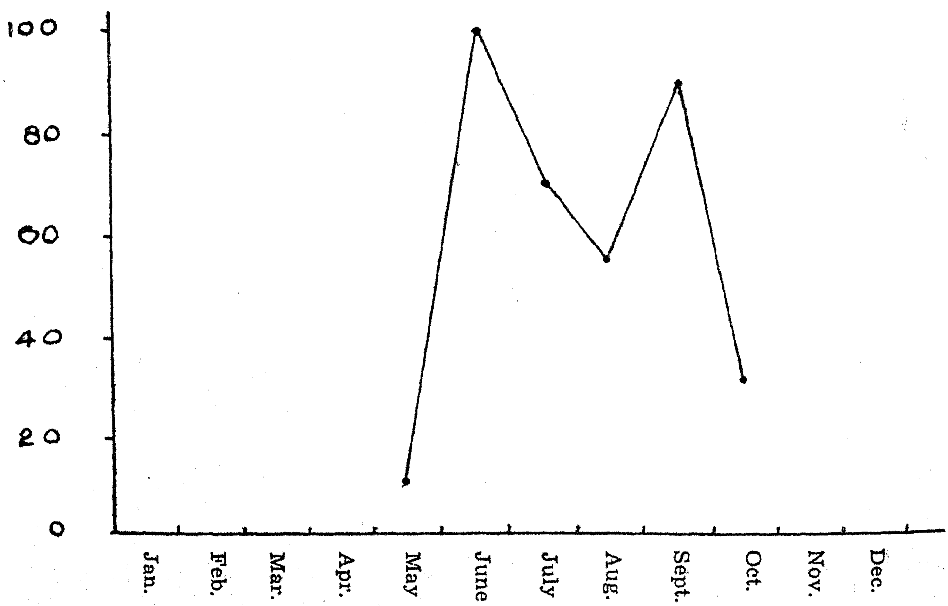
Text Fig. 4. Monthly Distribution of Plague Cases in Endemic Area of Northeast China in 1950.



Text Fig. 5. Monthly Distribution of Rodents found Infected with Plague in Endemic Area of Northeast China in 1950.



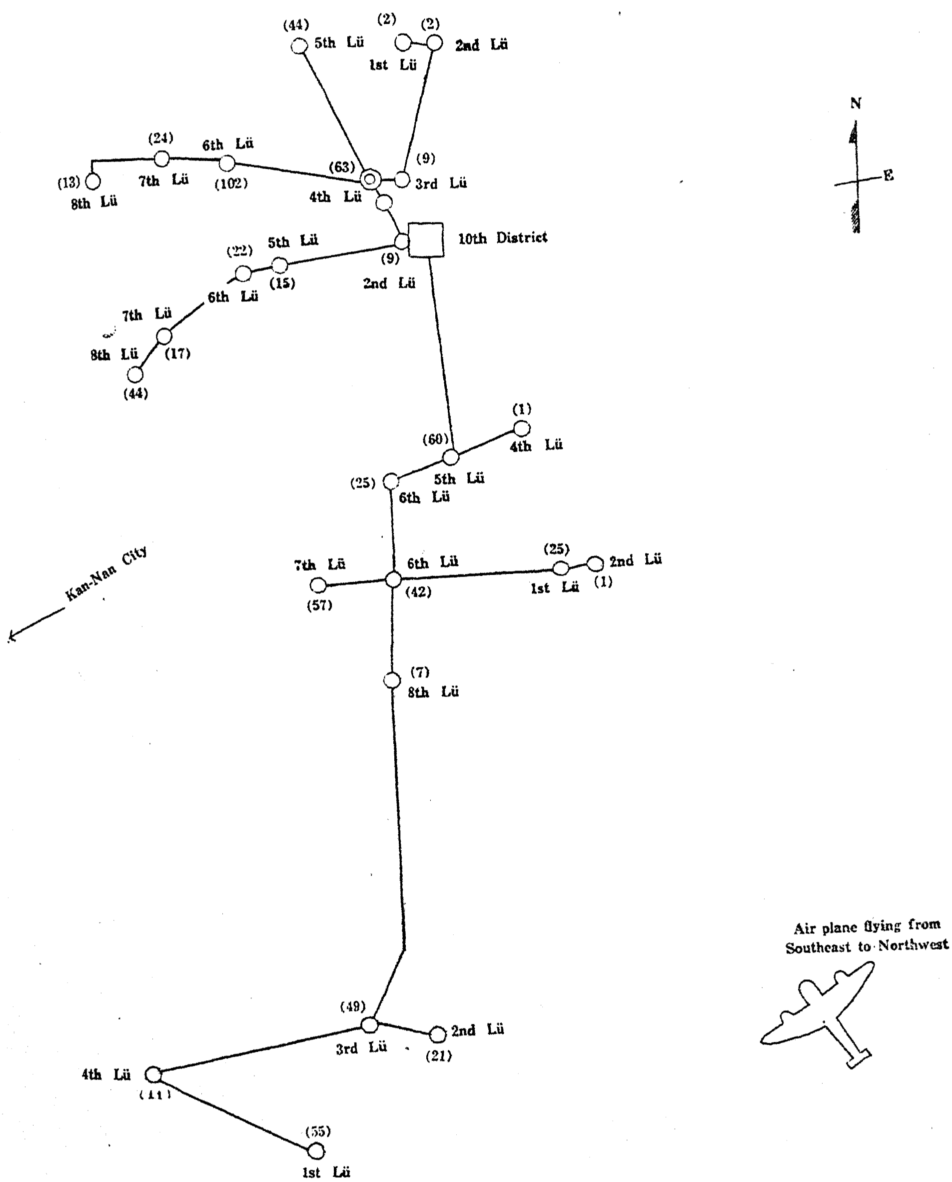
Text Fig. 6. Monthly Distribution of Plague Cases in Endemic Area of Northeast China in 1951.



Text Fig. 7. Monthly Distribution of Rodents found Infected with Plague in Endemic Area of Northeast China in 1951.

DOCUMENT M-8

SKETCH SHOWING THE ROUTE ALONG WHICH THE AMERICAN PLANE DROPPED VOLES IN KAN-NAN HSIEN



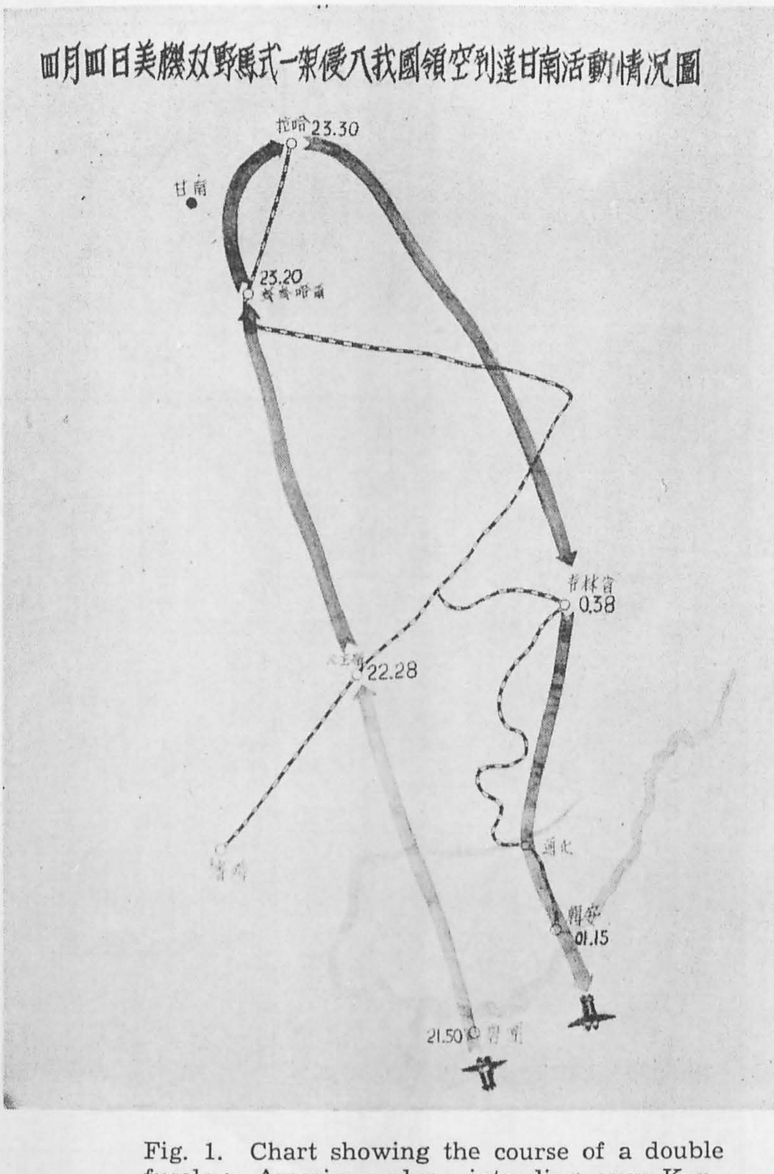


Fig. 1. Chart showing the course of a double fuselage American plane intruding over Kan-Nan on April 4, 1952.

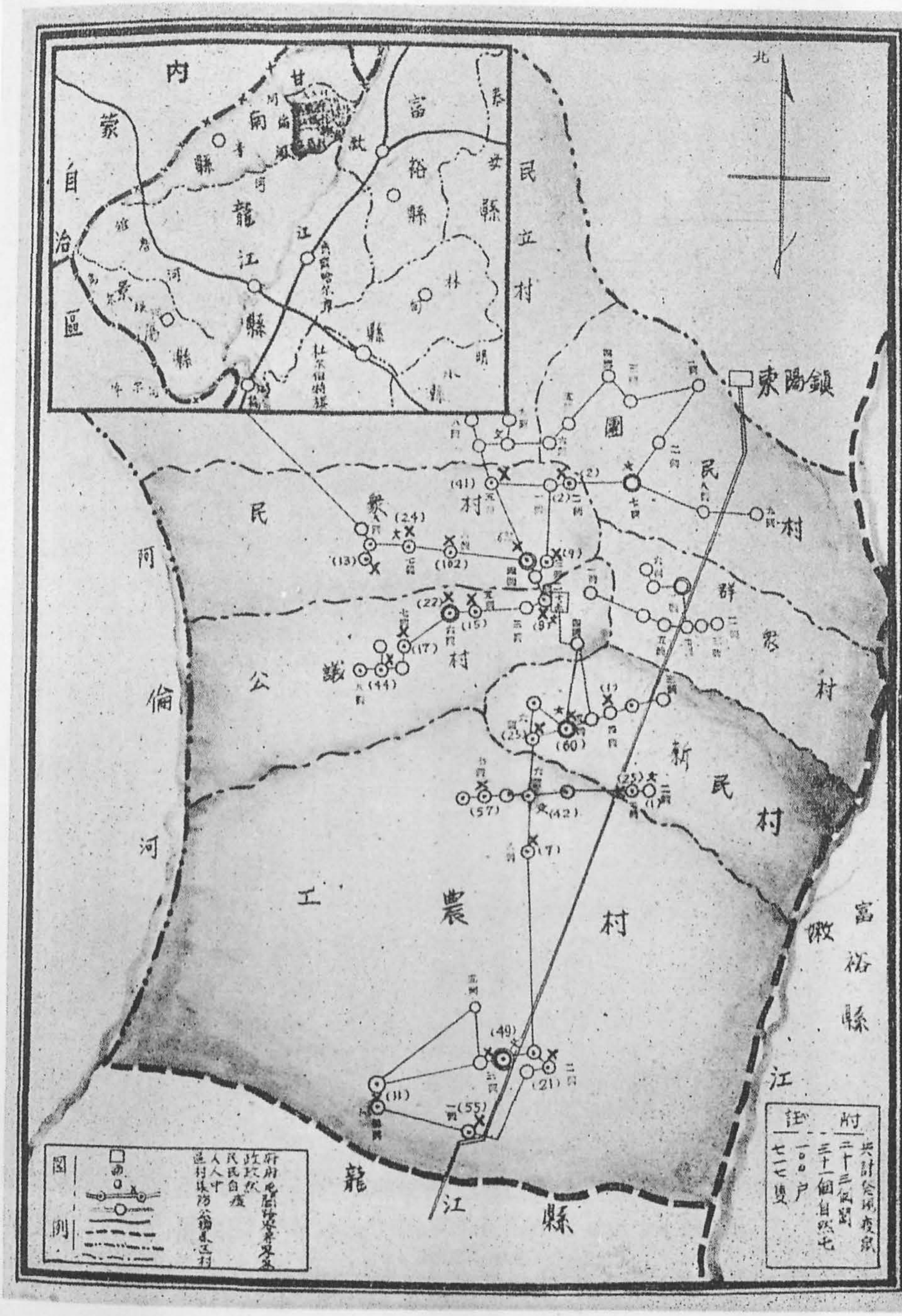


Fig. 2. Map of the tenth district of Kan-Nan Hsien showing where the American plane dropped the diseased voles. (The numbers in parenthess indicate the numbers of voles found).

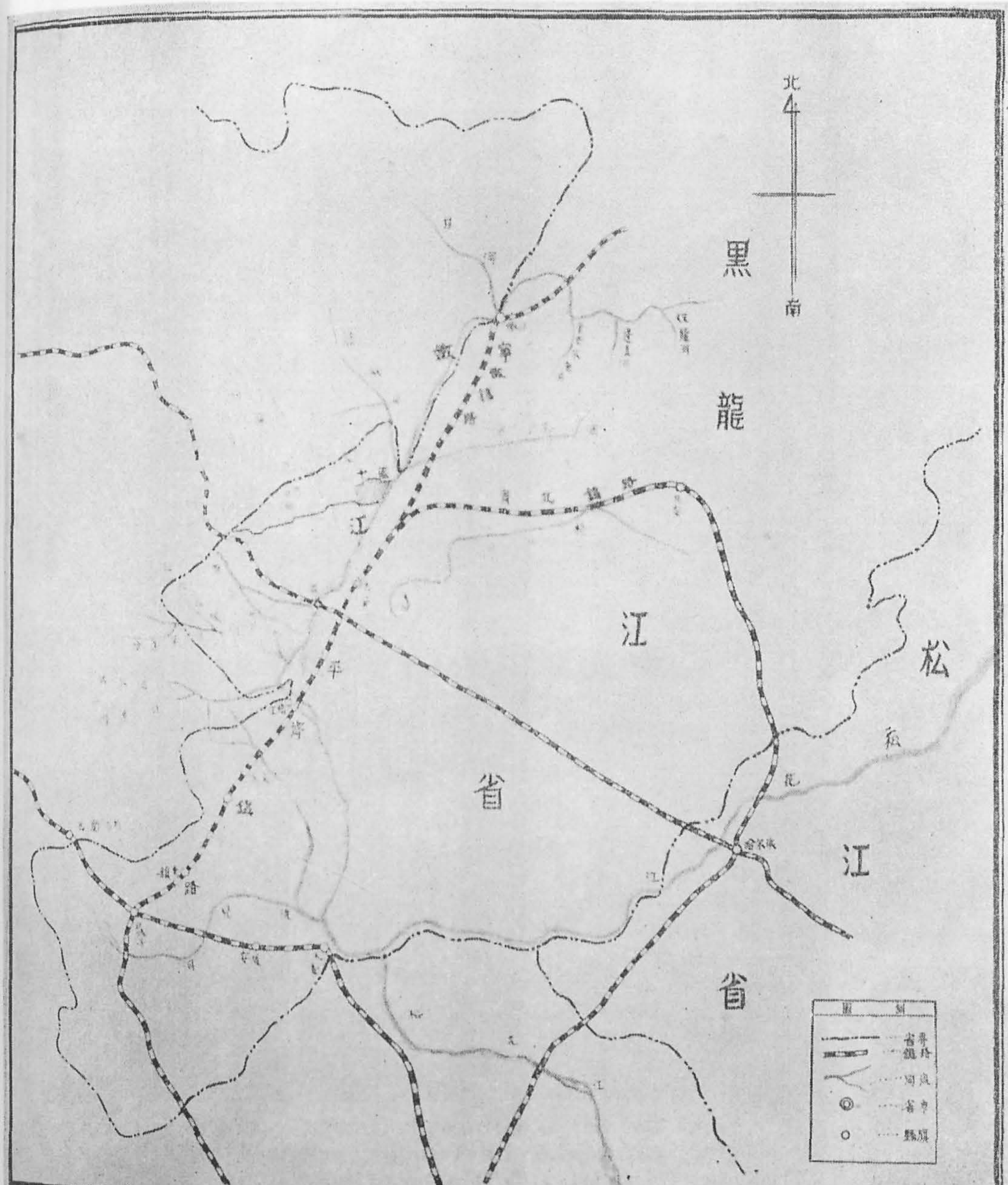


Fig. 3. Map of Kan-Nan Hsien and its neighbourhood.

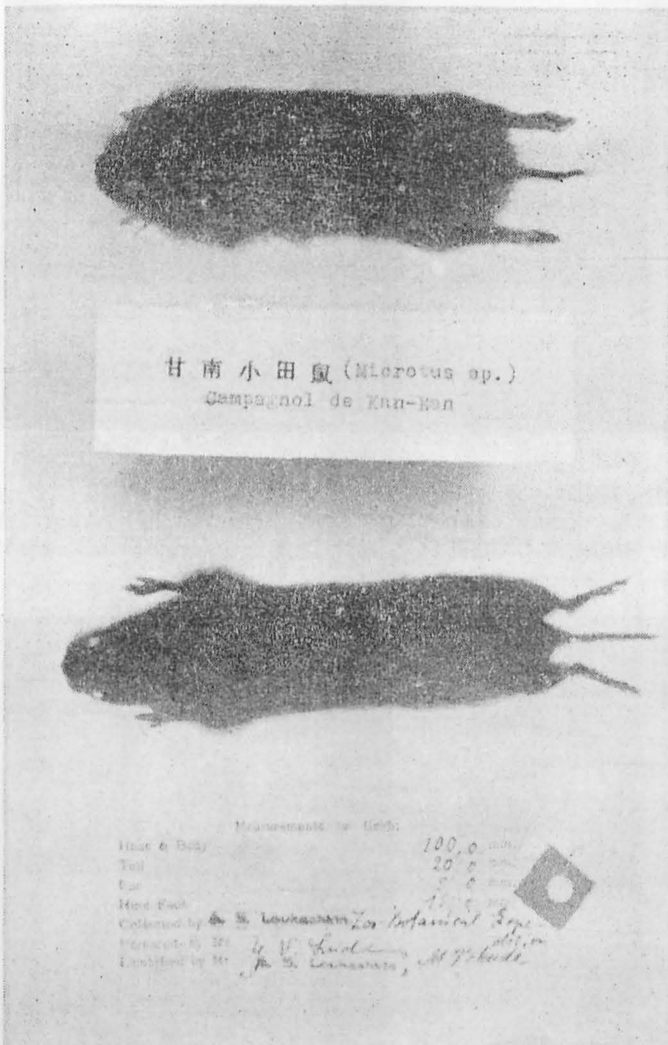
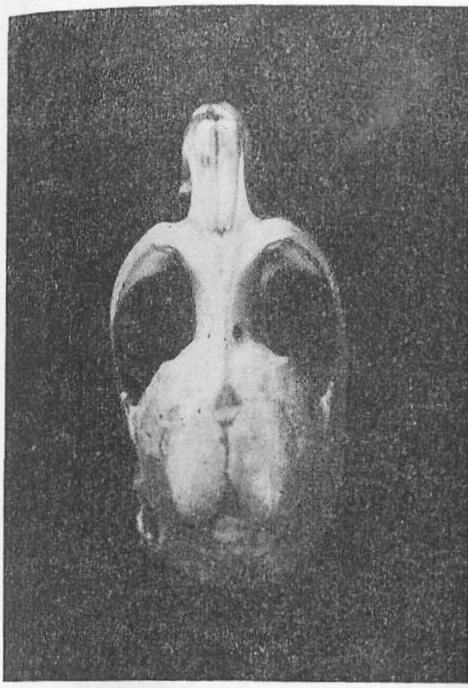
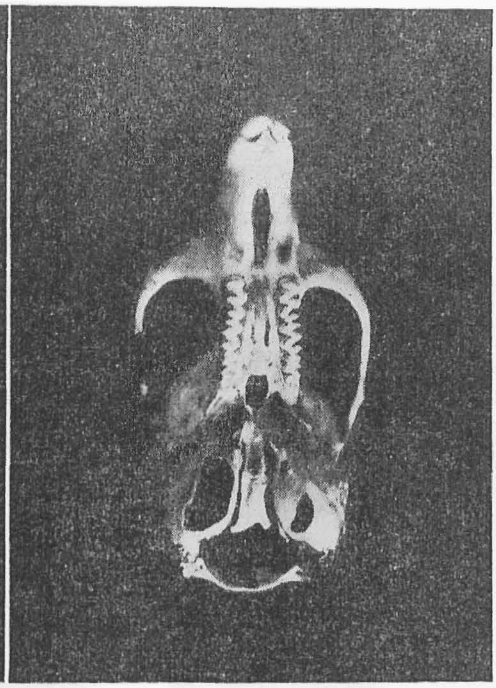


Fig. 4. External appearance of the vole found at Kan-Nan (upper) in comparison with *Microtus gregalis* (Pallas) (lower).



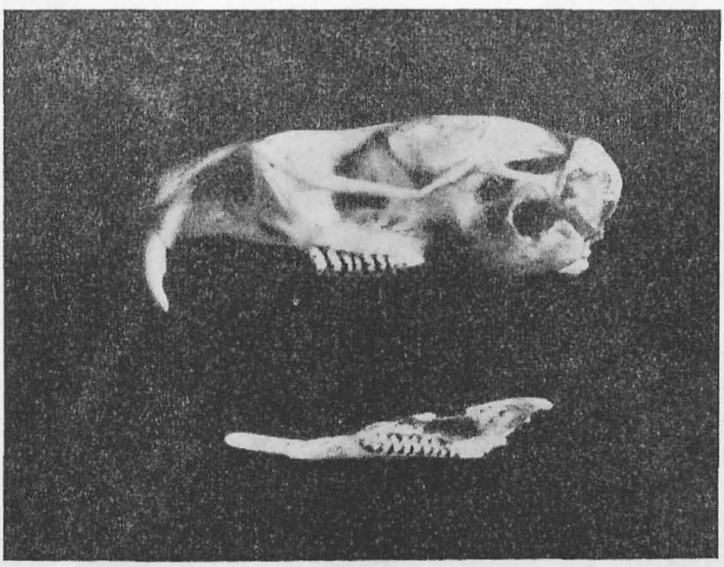
(×2.6)

Fig. 5. Skull of the vole found at Kan-Nan: Dorsal view.



(×2.6)

Fig. 6. Skull of the vole found at Kan-Nan: Ventral view.



(×2.6)

Fig. 7. Skull and mandible of the vole (*Microtus* sp.) found at Kan-Nan: Lateral view. Mandible, below.

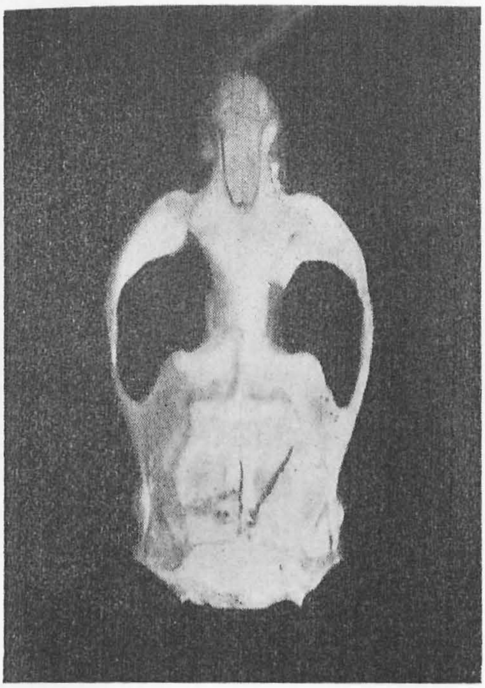


Fig. 8. Skull of *Microtus gregalis* (Pallas): Dorsal view. (×2.8)

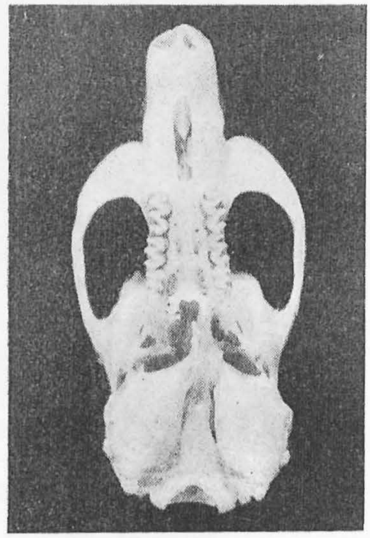


Fig. 9. Skull of *Microtus gregalis* (Pallas): Ventral view. (×2.5)

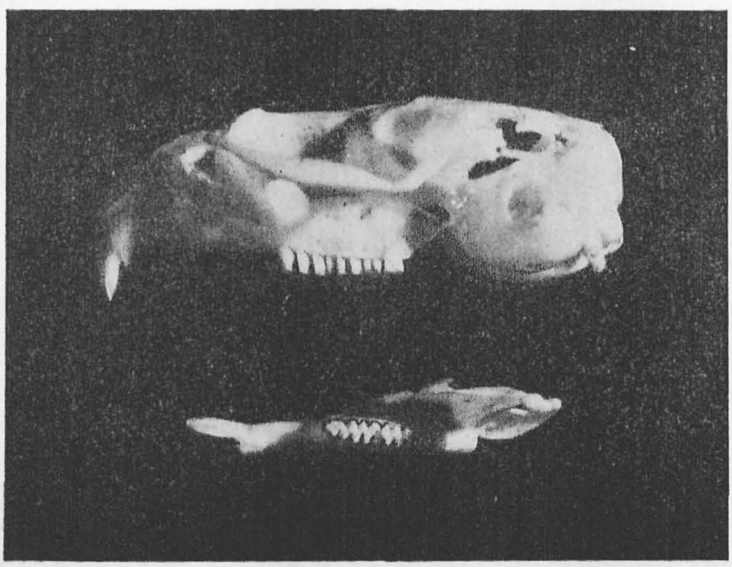


Fig. 10. Skull and mandible of *Microtus gregalis* (Pallas). (×2.8)

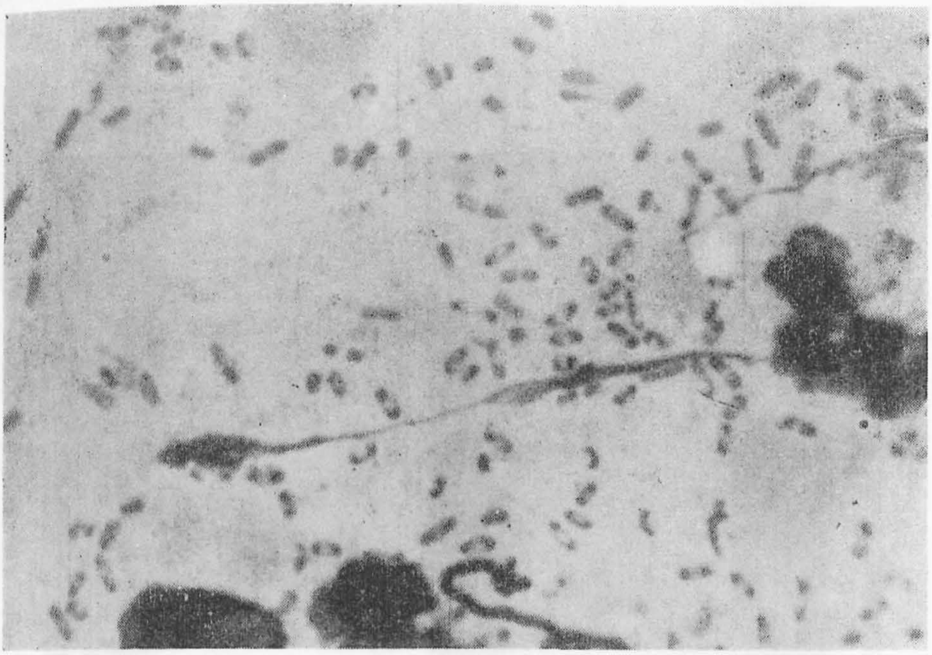


Fig. 11. Plague bacilli (*Pasteurella pestis*) found in the smear of guinea pig's internal organs (Loeffler-methylene blue stain)

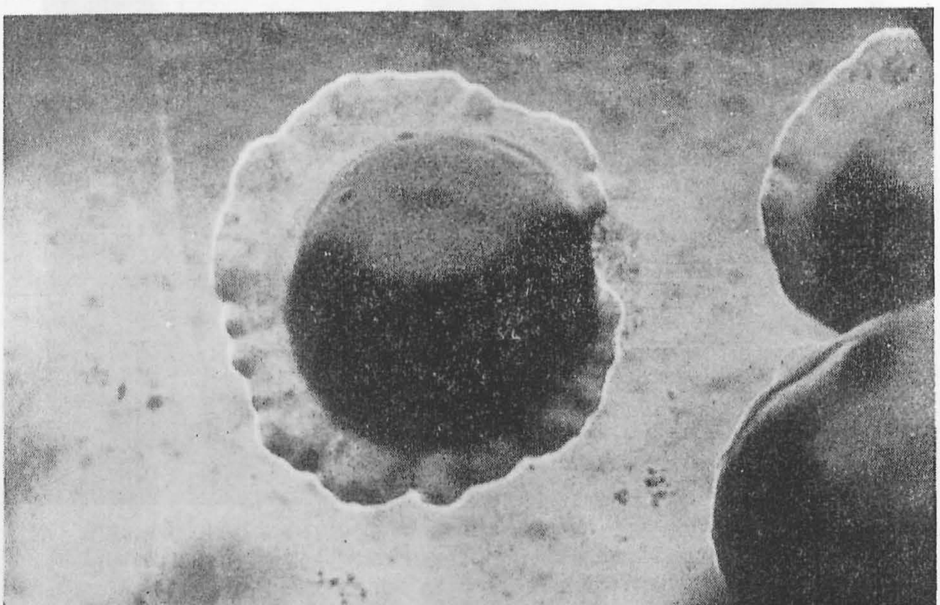


Fig. 12. Colonies of *Pasteurella pestis* after incubation for 48 hours.

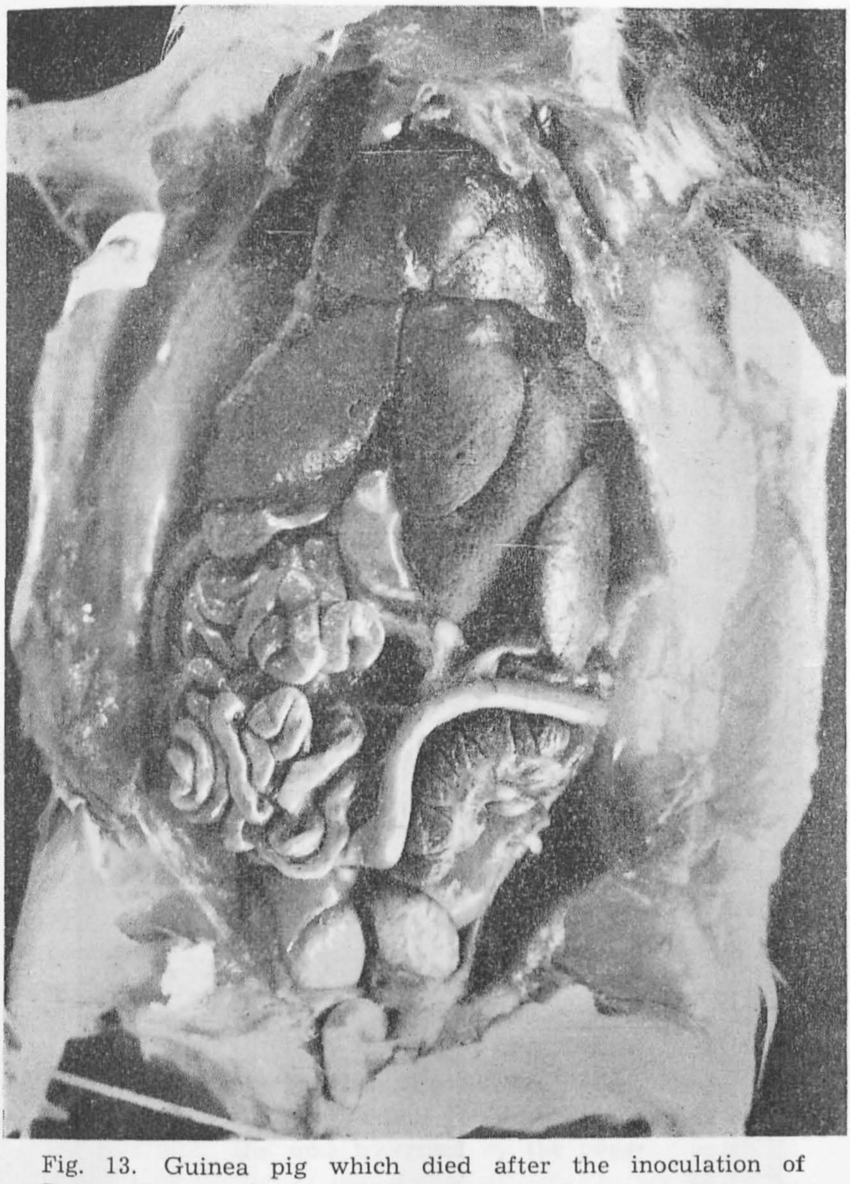


Fig. 13. Guinea pig which died after the inoculation of *Pasteurella pestis,* showing enlargement, congestion and hemorrhage of liver and spleen.

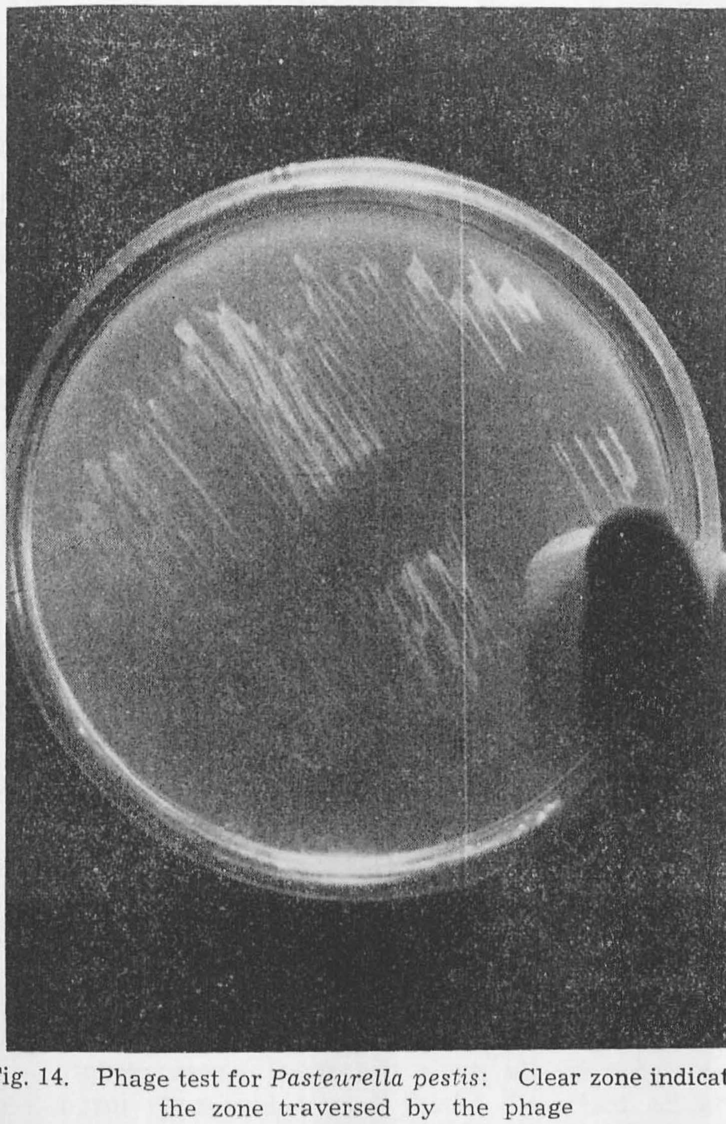


Fig. 14. Phage test for *Pasteurella pestis*: Clear zone indicates the zone traversed by the phage

APPENDIX N

Hearings on the Kan-Nan Incident: Depositions of Eye-Witnesses and Others; Observations of the Commission Made on the Spot; Assembly of Data

A. Depositions of eye-witnesses, 14th July, 1952

	Name	age	village	hamlet	how long resident in the region
1)	Ch'en Wan-fu	52	Minchung	4th	16 years
2)	Wang Yu	56	"	3rd	6 "
3)	Wang Ch'ing-yun	25	"	4th	25 "
4)	Yu Hsi-hai	58	"	4th	25 "
5)	Ch'en Kuan	31	Kung I	2nd	20 "
6)	Li Ch'ang-ch'ing	34	Kung Nung	"	26 "
7)	Liu Fêng-ts'ai	35	"	1st	15 "
8)	Ch'en Wan-ts'ai	15	Hsin Min	"	15 " (schoolboy)
9)	Hsueh Chuan-sêng	43	"	"	10 "
10)	Nieh Pin	31	Kung I (District Constable for 6 yrs.)	"	13 "

Answers to questions identified by following abbreviations:—

(A) Andreen, (M) Malterre, (N) Needham, (O) Olivo, (P) Pessoa, (Z) Zhukov.

1) Ch'en Wan-Fu when up in the middle of the night feeding horses, heard plane, making medium noise, but couldn't determine height. It was the first time that such a thing had happened. The plane came from the SE.

2) Wang Yu got up to go to the outside earthcloset in the middle of night, and heard the plane. Next day at day-break found the voles, as many as 7 dead ones on his k'ang. Noticed they were different from any rat-like animal previously seen. Destroyed them all as quick as possible, burnt them and buried them. Searched all around and found one more outside the house to the east. In and about the house as many as 9 were found, altogether.

(A) All the houses had cats, and almost certainly it was they which had brought the voles into the houses. Houses without cats had voles only in the courtyards. WY had

a male cat, and access to the sleeping-room was possible for it.

(P) WY had never found rats on his k'ang before.

(O) One vole fell down the well and was drowned. The well was about 15 ft. deep and 3 ft. diameter, with about 5 ft. depth of water. He fished it out with a basket.

(N) WY and CW-F did not notice any voles with broken legs. They did not touch the animals, which were dirty and flaccid.

3) Wang Ch'ing-Yun got up to feed horses before dawn. He trod on something which felt like a bundle of cotton, and then saw that it was a number of dead "rats" the like of which he had never before seen. His brother galloped off to warn the head of the district. Neighbours were certain that the "rats" were of a very strange kind, greyish black, with tail very short. Some were bleeding or wet at the throat; this he interpreted as meaning that the cats had been at them. However, he captured 3 alive and killed them. These were found later in a small pit used for storing potatoes, some 100 ft. away from the house. In all, 39 were found in and about the house.

(M) He felt no fleas and saw none. He had two cats, one of each sex. Afterwards all the cats were killed, and the dogs too, as a preventive measure, at noon on 5th April.

(N) He did not notice any broken legs, but the live ones could hardly walk, and staggered.

4) Yu Hsi-Hai saw "rats" at his friend's house (WC-Y) on the morning of the 5th. Had not heard the plane. When searching, they found behind another house a small pool of water, and in it two more animals of the same kind, drowned. Next day, April 6th, found a very shallow rathole in the fields, which was abnormal, because the local rats dig holes much deeper. In it he found an animal which he killed.

(A) Although it was alive it moved only with difficulty.

5) Ch'en Kuan found, at 5 a.m., a whole heap of dead "rats" (9) on his k'ang, of a kind never seen before. He had a female cat, but it was afterwards killed along with the others.

(M) He slept that night on the k'ang, had no flea-bites then or afterwards.

(N) Noticed no broken legs.

6) Li Ch'ang-Ch'ing found a vole when he was getting out his plough in the morning. It came towards him with a wavering gait. He had not heard the plane.

(M) Could not say about broken legs, because he killed the animal as quick as he could.

7) Liu Fêng-Ts'ai had been working on castor oil seeds and found two of the voles dead on the roof of his working shed.

(A) Didn't dare to touch them, because they looked so queer. At that time he did not know that others had been found.

(M) Had a male cat.

8) Ch'en Wan-Tsai (schoolboy) found the "rats" on the flat roof of the outhouse adjoining the home when he got up in the morning. He thought it extremely odd to find as many as 7 of them there.

(A) The roof of the outhouse was just about at eye-level. Before he went out he had not heard that anyone else had found any voles.

(N) Had not heard plane, and did not notice whether any limbs were broken.

9) Hsueh Chuan-Sêng found 3 voles on his k'ang in the morning, all dead, and had never seen such "rats" before. He warned his children against touching them, and later wooden sticks were used to remove them. Another 2 were found on the roof.

(M) His cat was female, and he heard it purring during the night. He saw or felt no fleas.

(N) The farmers did not dare to examine the voles sufficiently closely to find out whether any limbs were broken.

10) Nieh Pin was the district Constable to whom the news was brought from all sides. He rang up the local government headquarters. At his village 7 people had heard the plane come over. He quickly organized extermination squads.

Of the 713 voles destroyed, most were newly dead. Some had their heads broken, others had external lesions, others had their legs broken, and those that were caught alive moved about only with difficulty. Some had died in peculiar positions, e.g. with their paws in the air.

(A) The figure of 717 was the total derived from the reports from all the villages. The information was collected by health service cadres.

No evidence of any kind concerning possible remains of containers was found.

(P) NP had been District Constable for 6 years and had never seen or heard of any such phenomenon before.

(A) The population was not previously inoculated against plague, but it was done immediately after the incident. Heilungchiang Plague Prevention Service had much experience. The work was finished in 5 days.

(O) He estimated the number of cats in the villages as many as 500 all told. All cats and dogs throughout the villages were collected by midday on the 5th, killed and burnt.

(O) The area comprising all the 4 villages concerned is one of about 15 km. north to south and 5 km. east to west. Total number of inhabitants 4,811.

(Z) Domestic animals in the villages other than cats included horses, oxen, sheep, pigs, chickens, ducks and geese. No rabbits.

The fur of the voles found in the vegetable storage pits was definitely ruffled (indicating they were sick).

(N) The various injuries of the voles were definitely noted when they were first seen, and were not inflicted by the countryfolk themselves.

General Questions

(M) As to the moon and its position, witnesses could only say that it was a cloudy night with no moonlight.

(O) Ordinary local rats had been destroyed as a habitual measure, so far as possible, before the incident.

(P) No phenomena of swarms of insects had occurred in this region.

Container

Dr. Pai Hsi-Ch'ing reported that in an article printed in the Japanese weekly Mainichi, for 27th Jan. 1952, there was described in detail a method for landing rats in a paper cylinder attached to a parachute which might also be of paper. The cylinder splits open when it lands, allowing the rats to escape, and the paper is then set on fire and destroyed by means of a detonator and time fuse. Translation of the article in Appendix Q.

B. Questions Addressed After the Depositions of Scientific Specialists (qualifications in App. TT)

1) Dr. Chang Chieh-Fan (epidemiologist)

(O) As to whether all the vole injuries could have been caused by cats, it was to be noted that some of those injured when found were outside the houses and the settlements, and therefore not likely to have been mauled by cats.

(A) How were the 4 voles obtained for measurements and the 1 for bacteriological test?
(Answer also by Dr. Chi Shu-Li)

The 1 was one of the 4, and all 4 were brought in to a mobile bacteriological laboratory, the 1 having died the previous night and the others still earlier.

(Z) Mortality among rodents in the neighbourhood. Since 1947 nothing at all like this had been seen, never more than a few in twos and threes. CC-F had previously been in the focus of a rat epidemic, but even then the number of dead animals found had been nothing approaching this. It was not the right season for a rat epidemic in NE China, which should not come till May, while this was the beginning of April. Human cases in endemic areas usually followed. No phenomenon of mass multiplication of voles or rats (like lemmings), so far as CC-F knew, has ever been reported from the province.

(P) The only kinds of rats appearing normally dead before human cases are:

Rattus norvegicus (Lao shu), the sewer rat.
Citellus dauricus (Huang shu), the ground squirrel.
Mus wagneri (Hsiao lao shu), the house mouse.

2) Mr. Hsia Wu-P'ing (zoologist)

(Z) In the opinion of HW-P, the *Microtus* found was more likely to be a real species than a variety or sub-species of *gregalis*. It had several distinctive characters, some qualitative, some quantitative.

(O) The figures for measurements of *M. gregalis* in the Report (App. M) were taken from the literature, not from direct measurement. It was agreed that whatever it was, it had never been seen in or near Kan-Nan before. It would be very desirable to ascertain its exact origin.

3) Dr. Chi Shu-Li (bacteriologist)

(Z) As to the condition of the voles before examination, on account of putrefaction, the internal lesions were not easy to see. No strong odour, however, came through his thick mask. Laboratory animals injected with spleen and liver breis were white rats and mice; no guinea-pigs were handy at the time. No cultures were directly made at the time. (See the Report in App. M).

4) Dr. Ts'ui Ch'i-Shêng (bacteriologist)

(Z) He controlled all the bacteriological work with supervision and personal participation. The agglutination reaction was not attempted when the first cultures were made, but only later on.

C) Demonstrations in the Laboratories of the National Medical College, Shenyang.

13/7/52. In the presence of all the members of the Commission, Zhukov personally carried out a post-mortem examination of a guinea-pig which, as passage animal, had been infected with the Kan-Nan strain and had died the same day, and at the same time inoculated cultures on sulphite agar and on agar.

Demonstrations were then carried out by Ts'ui Ch'i-Shêng and Chi Shu-Li under the direction of Wang Pin and Pai Hsi-Ch'ing (Minister and Vice-Minister of Health, North-Eastern Region). Cultures of *P. pestis* were shown, microscopic examinations of the smears from liver and spleen made, the results of the phage test and the agglutination test were checked. Fermentation and hemolysis tests were demonstrated. The organism was clearly *P. pestis* and not *multocida, haemolytica, pseudotuberculosis* or other forms.

Demonstrations on the rodents were then made by Hsia Wu-P'ing.

15/7/52 and 17/7/52 Checks of cultures made by members of the Commission; positive results. Comparison of the Kan-Nan voles with specimens of *Microtus gregalis* brought from the Harbin Museum.

D) Visit of the Commission to the Kan-Nan Area.

15/7/52 The Commission proceeded by special plane from Shenyang (Mukden) to Chichihar, thence by special train to Laha, and then by road transport to the Chahayang State Farm.

16/7/52 The Commission proceeded to Kung-I village and thence to the villages of Minchung and Hsinmin, returning to Chichihar for the night.

17/7/52 The Commission returned by air to Mukden.

During its stay in Heilungchiang province, it was accompanied by the Chairman of the Province, Yu I-Fu, and by the Minister of Health of the North-Eastern Region, Wang Pin.

During its visit to Kung-I the Commission inspected the mobile or emergency bacteriological laboratory set up there by Chi Shu-Li and now under the charge of Hsu En-Li (M.B., Harbin). It comprised (a) reception-room (b) sterile chamber for examination of preparations (c) autopsy room. Since the incident the laboratory had continued to examine rodents and fleas locally caught, but no *P. pestis* had been found in either.

From the district office in Kung-I the members of the Commission went in jeeps to visit some of the people in the villages. The forms of life in these villages are still of an almost archaic simplicity. The houses are of terre pise, built with the reddish clay of the region, about 10 ft. high with an almost flat roof which presents a smooth surface due to its construction of clay and brushwood. The k'angs (heated sleeping platform) that fill about two thirds of the room are made of the same material and so are the hearths. The household utensils are very simple. There is not much furniture. Perfect order and cleanliness was found everywhere. The clay floors very well swept and so were the yards. No garbage was lying around, and very few flies were seen.

The Commission visited the house of Wang Yu (2). He showed the places where voles had been found. Members also inspected the well where one vole was found; the well now had a lid and was kept locked. Visiting Wang Ch'ing-Yun (3) members inspected the storage

pit where three living but sick voles were found; there were now potatoes at the bottom of it.

The Commission visited an obviously intelligent young man, Ts'ai Kuo-Ch'ing (Ts'ai Kuei-sen). After hearing about the voles he had made a search in his house. He then found two voles under a cupboard between the k'angs. They were alive but obviously sick. He killed one of them but saved the other in a bottle. This was the individual from which *P. pestis* was obtained. It had been easy for the voles to get in because his door could not be closed completely and there was an open space between the floor and the threshold. This man told the Commission about the measures taken to clean the house after the discovery of voles. Everything was carried out of the house into the yard. Finely cut straw was then spread over the floors and the k'angs and this straw was set afire. Then came the health team and "sprayed us with some kind of water. I don't know what it was but they sprayed so much that we and all our belongings got quite wet". This house had a male cat which was never at home.

The Commission visited a family with 6 children; the eldest son, a schoolboy was among the eyewitnesses (8). Members studied the roof where he found 7 voles. We also talked with his charming and capable mother while she quietly nursed the youngest of her children, aged 6 months.

As no women had been to Shenyang (Mukden), members made a point of talking with a number of them. They met one woman who had been awake at midnight, nursing a child of 3 months, and who had heard the plane pass. They also visited a house where two families shared one room. Two women were in the room. The younger one, nursing her child at daybreak had seen a heap of voles on her k'ang. She then woke up the elder woman. These women saw the cat carry in one vole after another, three in all. They found 16 voles on the k'ang.

Members asked all women met if they had seen any fleas. They all said no. They never used to have fleas and there had been none on the morning of April 5th.

It may seem strange that no fleas were seen. But it is very difficult to find fleas out of doors. Probably the fleas left the dying or dead voles before they were found by the cats. If any transferred themselves to the latter they were destroyed when the cats and dogs were killed and burnt at noon on April 5th. The villages were saved, it seems, by two circumstances: the thoroughness and the ruthlessness

of the measures taken by the health authorities and the disciplined cooperation of the villagers who never touched a vole with their hands and who volunteered to kill all their cats and dogs, of which they were no doubt fond.

E) Assembly of Data from Notes taken at Kan-nan, and other Sources

1) Plane. It was confirmed by the villagers personally that the plane came from the direction of the southeast. Its altitude could not be determined from their observations.

Information provided by the Chinese Air Observer Corps showed that

(a) the aircraft was an F/82 fighter plane with double fuselage, travelling at more than 500 km./hr. This is a night-fighter; the radar operator's space would doubtless be available for the bacterial warfare gear.

(b) It passed the Yalu river near Pi-t'uan at 21.50 on the 4th April.

(c) It was in the neighbourhood of Kungchuling at 22.28 (i.e. about halfway along a line between Shengyang and Harbin).

(d) It was in the neighbourhood of Chichihar at 23.20.

(e) It was over the Kan-nan area around 23.30, where it spent a couple of minutes.

(f) It then turned, crossing the Nonni R. and the railway a short distance southwest of Laha, afterwards making its way back towards the Yalu river along a route similar to that by which it had come.

This information source stated that the night was overcast without rain or much wind, thus confirming the peasants' statements.

2) Delivery and Container. The facts seemed to be compatible with the use of self-destroying paper canisters and parachutes similar to those described in the Mainichi article, (App. Q). In order to prevent the rats escaping from the containers before the proper time, and to permit the rapid delivery of the containers in the short period taken, it would be plausible to assume that the containers were kept in a closed box filled with some anaesthetic vapour. This would be dissipated during the descent, which might well be assessed at some 5 minutes, from 6,000 ft. Furthermore, if the cylinder was

set to open at some height less than 50 ft., the container and parachute could drift away a considerable distance and so escape discovery.

Study of the distribution-map of voles found (App. M) seemed to indicate that there had been three foci of delivery, along a line slightly SE/NW. While it must be remembered that this distribution includes also such re-grouping as was effected by the cats, their operations would mainly lead to a concentration from zones around village agglomerations into the agglomerations themselves.

3) Population of Animals, and their Condition.

It was confirmed from Nieh Pin and other villagers that there were no perceptible differences in the size of the members of the vole population collected and destroyed. All were adults. This would probably not have been the case with a natural population.

The condition of the vole population during the night of the 4th, and 5th. April depends upon the answers to the following questions:

(a) Were the voles diseased when they reached the ground?

Here the following points are relevant:

(i) According to one account, the animals came forward to meet men, a most unusual behaviour which frightened one of the peasants.

(ii) Specimens caught alive were caught very easily and their fur was ruffled as it is on animals which are ill.

(iii) It was evidently easy for the cats to catch the voles and bring them into the houses.

(iv) Voles were seen moving with difficulty by several observers.

(v) The only vole found digging a burrow was so weak that it had been able only to achieve very little by the morning of the 6th.

(vi) The one which was caught under a cupboard and preserved alive in a jar most commendably by the

peasant Ts'ai Kuei-sên, was described by him as appearing to be very ill.

(vii) Finally, there is the bacteriological evidence later obtained from this vole.

From these facts the conclusion that the majority of the voles were suffering from plague when they landed would follow. It is hard, however, to rule out the possibility that they were dropped in some manner so brutal as to cause them serious injuries, on the presumption that their value as plague carriers would be almost as great dead as alive. Moreover, the two possibilities would not be mutually exclusive. A further point to be noted is that the behaviour of laboratory-bred animals when liberated into natural environments is well-known to be lacking in defensive reaction, and this again might apply in the present case.

(b) Were the voles dead or dying before the cats found them? Here the following points are relevant.

(i) There were accounts of houses possessing no cats where nevertheless dead voles were found in the courtyards.

(ii) There were at least two accounts of voles in open wells. They could not have been dropped in by cats, nor fallen in if they were in a normal state of health.

(iii) Voles found drowned in shallow pools would under normal circumstances have climbed out.

(iv) On the roofs of three different houses in two villages groups of dead voles were found with no evidence of cats' interference. These roofs were carefully examined by the Commission and no rat-holes of any kind could be found.

This question, like the former one, must then be answered in the affirmative.

(c) Were the lesions of the voles present before the cats found them?

According to the eye-witness evidence, only Nieh Pin considered that he had seen broken legs. It may therefore

be more plausible to suppose that the idea of broken legs was a conclusion drawn by the peasants in subsequent discussion from the fact that the voles seemed to be ill and walked with a staggering or wavering motion. The only evidence for injury before the attacks of the cats comes from the observation that voles lying on roofs in positions which the Commission considered were not such as would have been likely to have been chosen by cats, had bled from their noses.

APPENDIX O

Report on the Comparison Between the Voles Collected at Kan-Nan and *Microtus gregalis* (Pallas)

(ISCC/2a)

The voles collected at Kan-Nan are most closely related to *Microtus gregalis* (Pallas). For the purpose of a further investigation of their morphology, a comparison is made as follows:

The data for three of the *M. gregalis* are taken from Tokuda*. The data for the fourth one are our own measurements on a well preserved specimen kept in the Harbin Museum (one of the three specimens studied by Tokuda is also kept there).

I. Description of the morphology of the voles collected at Kan-Nan.

Specimens of Kan-Nan voles examined: Four in number, one of which was only a skull without skin. They were all collected from Min-chung Village of the Tenth District, Kan-Nan Hsien, Heilungchiang Province.

Date received: April 10th, 1952.

The specimens are medium sized, 85-100 mm. in length. They have a dark coloration, much darker than *Microtus brandti* and *M. gregalis*, but not as dark as *M. pelliceus*. Pelage on the back consists of long hairs the base of which is dark gray thus rendering it dark in color. The cream-buff color on the tips of the hairs is quite prominent with a length of more than 3 mm. These two features make its coloration quite different from that of *M. gregalis*. The coloration is even over the whole body, that on the sides being the same as on the back. The tail is very short, being less than 1½ of the length of the hind

* Tokuda, M. 1941. A revised monograph of the Japanese and Manchou-Korean **Muridae.** Trans. Biogeogr. Soc. Japan, 4, pp. 1-156.

foot, and on the average, 1.12 times. The color of the upper surface of the tail differs from that of its lower surface which appears yellowish buff. Ears are small, being hidden under the hair. There are six plantar pads; the feet are covered with hairs, with the exception of the pads and the parts further distal.

The skull is narrow and long, the zygomatic breadth being slightly greater than one half of the basal length. The inter-orbital breadth is very short, measuring only 2.6-2.8 mm. In the upper middle part of the inter-orbital region there is a distinct median dorsal crest the posterior of which is separated into two, and together with the posterior ridges formed a rectangular area on the cranium. The top of the cranium is relatively flat. The posterior end of the palate terminates into a median ridge, separating two lateral pits. The rostrum is rather strong being wider than the inter-orbital breadth. The third lower molar does not form a solitary triangle. The third upper molar is simple, being formed of four triangles. The first lower molar forms five solitary triangles between the anterior and the posterior loops; the anterior loop is not formed into a triangle, despite the presence of a depression.

II. The morphology of *Microtus gregalis* (Pallas) (after Tokuda)

"Size medium. Form somewhat elongate. Color considerably pale throughout and in general like in *Lasiopodomys brandti*, but being distinctive in the slightly warmer color of individual hairs and in having evidently admixed blackish hairs over mantle. Fur moderately thick, 13-15 mm. long. Hairs of belly cream-buff terminally, the grey bases rather evidently showing through. Tail short, nearly one-fourth as long as head and body, well clothed with buff hairs except for a narrow dark line along the surface. Ears reduced, not evidently projecting above the fur; the hairs as on the back. Soles decidedly longer than palms, much overgrown with hairs except on the pads. Plantar pads five. Claws without peculiarities.

"Skull very narrow, zygomatic breadth surpassing only slightly one-half of basal length. Interorbital region strongly constricted, on which a flaring median crest is formed by fusion of temporal ridges. Posterior extension of the ridges delineates a remarkable square area on braincase in the same manner as in the skull of *Lasiopodomys*. Postorbital crests small but rather conspicuous. Structure of palatal termination typical of the genus, except that the palatal pits are slightly deeper and the median ridge between them is narrower and longer.

Mesopterygoid fossa deep and narrow. Rostrum appears to be heavy for the rest of the cranium, its width decidedly larger than interorbital width. Auditory bullae of medium size, with rather dense internal filling of spongy tissue. Upper incisors nearly perpendicular.

"Dentition considerably weak. Each triangle of molars encloses a rather small dentine space, and well defined from one another by deep re-entrant folds. Pattern of $M\underline{3}$ rather simple, usually with four closed spaces and a slightly elongate posterior crescent. $M\overline{1}$ with a large anterior loop which is distinctly indented on each side, sometimes the external re-entrant angle is so deep as to divide the loop into two spaces and thus yields six closed triangles between anterior and posterior loops. $M\overline{3}$ without any trace of antero-external angle."

III. Comparison between Kan-Nan specimens with *M. gregalis* (Pallas)

1. External features:

(I) A darker coloration of the pelage: The specimens collected at Kan-Nan on April 5th should have a winter fur, while the specimens of M. *gregalis* (Pallas) kept in Harbin Museum, being collected in June, should have a summer fur. Usually the summer fur should have a darker coloration than the winter fur. (That of animals brought up under artificial conditions is exceptional.) However, the Kan-Nan specimens have a remarkably darker color than the specimen of *M. gregalis*. This point would therefore indicate that the Kan-Nan voles are probably a subspecies different from the museum specimens.

(II) A shorter tail: The ratio between the tail length and hind foot length of Kan-Nan specimens is on the average 1.12, whereas that of *M. gregalis* is 1.60. (cf. appended table for measurements).

(III) Number of plantar pads, 6 for Kan-Nan specimens, but 5 for *M. gregalis*.

2. Measurements of the skull:

(I) A greater inter-orbital breadth: 2.6-2.8 mm. with an average of 2.73 mm. for Kan-Nan specimens; 2.4-2.8 mm. with an average of 2.6 mm. for *M. gregalis*.

(II) Greater diastema: In general, Kan-Nan specimens have greater diastema than *M. gregalis*.

3. Statistical analysis:

In order to judge the significance of differences in various determinations, a number of measurements and ratios have been analyzed by the following method:

(I) The averages ($\overline{X}$) of various measurements are calculated.

(II) The values of t are calculated according to the following formula:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{\Sigma(X_1-\overline{X}_1)^2 + \Sigma(X_2-\overline{X}_2)^2}{N_1 + N_2 - 2}\left(\frac{1}{N_1}+\frac{1}{N_2}\right)}}$$

(III) Whether the differences is significant or not is decided by the value of t.

When $t > 3.9$, the difference is definitely significant;

$t > 2.5$, the difference is probably significant;

$t < 2.5$, the difference is probably insignificant.

The results are given in the following table:

Measurement or ratio	Average value		t	Significance of difference
	Kan-nan specimen	M. gregalis (Pallas)		
Head and body length	93.7	103.5	1.39	—
Inter-orbital breadth	2.73	2.6	1.38	—
Diastema	7.9	7.7	0.69	—
Tail length/hind foot length	1.12	1.6	3.1	+
Height of skull/basal length	0.30	0.33	0.27	—
Zygomatic breadth/basal length	0.52	0.54	0.30	—

From analysis it appears that there is a statistically significant difference between the ratio tail length/hind foot length of Kan-Nan specimens and that of *M. gregalis*. The differences in the measurements of the interorbital breadths and the diastema are probably not significant, and those in the ratio height of skull/basal length as well as the ratio zygomatic breadth/basal length are even less remarkable.

Comparison of Different Measurements Between Kan-Nan Specimens and *Microtus gregalis*

(unit of measurements millimeter)

	Kan-Nan Specimens				M. gregalis			
					Tokuda's data			Harbin Museum sp.
External Measurements:								
Head and body	—	96	85	100	104	100*	93	117
Tail	—	21	18	17	28	20	22	26
Hind foot	—	17	18	15	15	15	15	15
Ear	—	9	10	8	11	9	8.5	11
Tail length/hind foot length	—	1.23	1.00	1.13	1.87	1.33	1.47	1.73
Cranial Measurements:								
Basal length	23.5†	—	—	22.1	24.3	24	23.9	23.8
Palatilar length	12	11.8	11.8	12.0	13.7	13	13.4	12.7
Diastema	8.2	8.0	8.2	7.2	7.6	7.5	7.5	8.3
Zygomatic breadth	12.2	—	—	11.5	13	13	12.3	13.5
Nasal length	6.9	6.9	6.3	5.6	7.2	6.3	7.1	7.2
Inter-orbital breadth	2.8	2.7	2.6	2.8	2.6	2.6	2.4	2.8
Incisive foramina	4.6	4.0	4.1	3.7	4.5	4.8	4.4	4.9
Upper cheek teeth row	5.6	5.7	5.6	5.5	5.8	5.6	5.4	5.9
Breadth of 1st molar	1.2	1.1	1.1	1.1	1.1	1.1	1.2	1.2
Audital bulla	5.7	—	—	5.5	7.5	7.5	6.5	6.3
Breadth of rostrum	3.8	3.8	3.6	3.5	—	—	3.9	4.1
Height of skull	6.8	—	6.7	6.8	7.8	8	7.6	8.3
Zygomatic breadth/basal length	0.52	—	—	0.52	0.53	0.54	0.51	0.56
Height of skull/basal length	0.28	—	—	0.31	0.32	0.33	0.32	0.35

* This specimen is kept in Harbin Museum.

† This specimen is the only complete skull of those buried voles recovered on July 3rd, 1952 from Min-chung Village, Tenth District, Kan-Nan Hsien.

IV. Discussion:

Taxonomists generally consider the characteristics of a species on the basis of its external morphology, such as external measurements, coloration of pelage, cranial and dental structures, etc. It is possible

to identify the specimens when the differences in these characters are remarkable. However, specimens, if numerous, may show continuity in these characters; it is then inappropriate to define them as different species. The statistical analysis of the present data has revealed that the differences in various measurements of the skulls of these specimens are probably insignificant; whereas a probably significant difference exists in the ratio between the tail length and hind foot length. A difference in the number of plantar pads is distinct, Kan-Nan specimens have six, being one more than *M. gregalis* (Pallas) as recorded by Tokuda. Recently the number of plantar pads has been adopted as a criterion for classification, which is now generally considered acceptable. However, whether this alone could be sufficient to decide upon a differentiation in species needs further study.

In conclusion, the Kan-Nan voles appeared to be different from the *Microtus gregalis* (Pallas) described by Tokuda on the following three aspects:

(1) The pelage of Kan-Nan voles has a darker coloration.

(2) Kan-Nan voles have shorter tails, the tail length being less than one and one-half the length of hind foot.

(3) Kan-Nan voles have one more plantar pad than *M. gregalis.* (Pallas)

Basing upon these aspects it may be said that there are distinctions probably of a subspecies grade between the Kan-Nan voles and *M. gregalis* (Pallas).

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Date of report: July 18, 1952.

APPENDIX P

Commentary on the Identification of Voles

In a preliminary report, the Chinese zoologist Mr. Hsia Wu-P'ing, a specialist on rodents, thought that the Kan-Nan voles could be identified as belonging to the genus *Microtus* of a species yet unknown in the locality, and probably different from the *Microtus gregalis.* He arrived at this conclusion, on the basis of several characteristics partly qualitative and partly quantitative.

However, the Commission was not fully convinced and made a few remarks on the species identification. In the work of Tokuda covering the genus *Microtus* of NE China which was used in the comparative studies, it is emphasized that precautions must be taken before identifying a new species or sub-species, "the research worker very often classifies the species into several local sub-species without important foundation. For instance, the size, the color and the type of fur were relied upon to create small groups; one is thus able to have an infinite number of subspecies, whilst the taxonomic entity is left aside. Statistics should prove whether the variation is continuous or not. In the former case, calling it a subspecies is unjustified."

Concerning *Microtus gregalis,* Tokuda insists furthermore on the relative ignorance of its geographical distribution; nevertheless it is definitely found in Inner Mongolia, North China and Northeast China. Tokuda states further: "A considerable number of geographical forms of this vole have been described by many workers. It is, however, very doubtful how many of them are really distinctive from the present species, since there exist many intermediate forms."

Following our remarks Mr. Hsia carried on further studies on the specimens and he asked to be sent from the Harbin Museum two samples of *Microtus gregalis,* one of which was formerly identified by Tokuda himself. The Commission was present during the course of comparative studies on the voles, and suggested the studies on some indexes instead of relying solely on absolute measurements of specimens and also suggested analysis with statistical methods.

The new studies were carried out carefully by Mr. Hsia and the results are given in Appendix O. The Chinese zoologist did everything

scientifically possible. Given the fact that only a very small number of observations was available, reliance cannot be placed on the "t" values. Consequently, the differences in the measurements and in the indexes of the skull of Kan-Nan voles are not important. The only significant index would be the ratio of length of tail to length of hind foot. This index is of value if the materials were homogeneous (sex, age). It is an essential condition in these studies to have a large number of specimens of the same age and sex. It is important to note, according to Tokuda, in the rodents: (1) the lengths of the head and of the body continue to develop after sexual maturity, (2) the ratios tail-head and tail-body are variable according to age and (3) the hind feet reach their full length before other parts of the body.

The only distinctive characteristics remaining are deeper color of fur of the Kan-Nan voles and an extra plantar pad as compared to the *Microtus gregalis*. The exact importance of number of pads in classification is not yet well established. In conclusion, there is no ground to believe that the Kan-Nan voles belong to a new species. But this scientific problem, i.e. the identification of a new species, which is arduous, and time consuming, difficult and debatable, has in fact no essential bearing in the solving of the Kan-Nan incident. To achieve this, we can make use of other procedures.

What are the concrete facts?—In four villages of an isolated district in Northeast China, 717 voles dead or dying were suddenly discovered. These represented the total number remaining after one evening's hunt by about 500 cats, during the night of 4th to 5th April, 1952. It is fair to guess that the actual number of voles were higher, may be over 1,000.

This mass of voles did not reach Kan-Nan district as a natural migration; no trace of their passage was found in the surrounding districts. Equally evident, these voles could not have multiplied themselves all of a sudden in an area, where according to existing references, they are found in rare circumstances. Also, neither immediately before, nor immediately after the incident were similar specimens found in the said district. These specimens were, moreover, unknown to the local population. They were definitely voles, living in the countryside, never in human habitations. We may conclude with certainty that a large population of rodents were taken into the district by artificial means and in one lot.

Many important problems have to be solved and to these we have to consider the following:

(1) the geographical origin of the said species,

(2) whether the voles are obtained from their natural population or from artificial breeding.

Each of the above possibilities will be discussed.

(1) In order to ascertain the exact geographical origin of the species, numerous specimens of voles found in Kan-Nan would be required for studies. The Kan-Nan voles would have to be compared with other specimens of the genus *Microtus* collected from all the surrounding areas. It is naturally obvious that prophylactic necessity had ruled out this possibility as the Kan-Nan voles had to be destroyed by fire at the very beginning. Also, studies on this aspect of geographical origin would require months and even years of work. And from the practical point of view, the results of these studies do only have a limited importance in the solving of the Kan-Nan incident, as it will be shown in the next paragraph.

(2) Is it feasible for the author of this vole dissemination to have collected a thousand or more rodents, captured alive from a murine population, scanty in normal circumstances? It is absurd to think that such a "crop" of live voles is plausible—whilst it is justified to conclude that the Kan-Nan voles came from an artificial breeding source, if moreover we take into consideration that they all are of the same size and same appearance, an indication of same age.

From the statements gathered during the trial of Khabarovsk, Ishii was known to have taken along with him to Japan various live species of voles collected from Northeast China.

We cannot help associating these facts from a recent news release. The Tokyo paper "Kowa Shimbun", dated 7th August, 1952, published the news that in the Saitama county (Japan) there is an "Institute", under the direction of Ojawa, a former staff under Ishii, which can breed on a large scale great numbers of rodents.

We can thus see the relative importance of finding out the geographical origin and the species identification of the Kan-Nan voles. We must point out that it is easy to obtain a few rodents from Northeast China and start on breeding under various artificial conditions. It is then easy to have the necessary quantity of rodents for dissemination in areas outside their normal habitat—in which case we have an abnormality in geographical origin.

The fact that the Kan-Nan voles had their origin from artificial breeding will also explain some of the morphological data presented. Such artificial breeding is usually started from a very few parental strains, may be even from a single pair. This will produce close consanguinity. As an end result, this genetic process will give rise to an artificial selection in such a way as to produce characteristic deviations from those of the original population.

Moreover, apart from the genetic factors, the environment (climate, nutrition, habitat) will produce also characteristic modifications (hair, color, temperament) which geneticists call phenotype.

In conclusion, concerning the identification of the Kan-Nan voles, we can state that they belong probably to a variety of *Microtus gregalis*, reported by Tokuda from western part of North-east China, which had been obtained through artificial breeding. Anyway, they all gave the impression of same age development, and were unknown to the local population and never seen again after the incident.

APPENDIX Q

Article "Bacteriological Warfare"

(From Sunday Mainichi (weekly) No. 1682 January 27, 1952, in Japanese)
By Sakaki Ryohei, formerly Major, Epidemic Prevention Service, Japanese Kwantung Army

(Abridged Translation)

(1) BACTERIOLOGICAL WEAPONS

One day in October, 1936, a routine "midnight conference" took place in newly built conference room. There were present more than sixty people. It was the first meeting since the beginning of regular investigation. Speaking at the conference, Bushikawa, the officer in charge of the Corps, said: "Our research laboratory has completed all its preparatory work. The Corps, working on an island, has been entirely isolated from its surroundings. For research there could be nothing better than such an environment. As for equipment, machinery and chemicals, even water, gas and electricity supply, nothing necessary has been lacking. There is a tremendous contrast—between the facilities now and the primitive state of these remote places when Kobata, Misiyama and I first arrived."

To make use of bacteria and other micro-organisms as weapons is not only definitely possible, but it is now also certain that they will become very strong and powerful weapons. Henceforward it will be a main task to find out how to convert them into effective weapons. For this purpose, we must endeavour to increase the virulence of the bacteria and shorten their incubation period in order to make them effective weapons which could exhaust rapidly the enemy's fighting power. We expect to improve the culture media by additional agents in order to accelerate the growth of the bacteria, and to study the methods of passing the bacteria through successive animal bodies in order to increase their virulence. Secondly, it will be necessary to convert further the paste-like bacterial growth on culture media into a form easy to handle, for example, to convert them into dried powders without killing the bacteria.

Bacteriological weapons ought to be applicable in the following situations:—at the front and behind the lines; military stations and bases; and for strategic purposes. The methods of their dissemination should

also be studied, such as shelling, bombing, raining, spreading, spraying, etc. For the purpose of constructing special instruments suitable for use in the above-mentioned situations, vessels simple and easily handled but accurate, must be devised. Furthermore, for those species of bacteria which require intermediate vectors such as small animals, insects, plants, etc., research work must be performed on the methods of feeding and breeding these intermediate organisms.

Bacteriological weapons are the most suitable and cheapest weapons when a country, such as Japan, is extremely short in resources. From a small research laboratory and a number of test tubes, weapons can be readily made which will exterminate troops by thousands.

Although research for converting bacteria into weapons of war may seem to conflict with the traditional stand point of medical doctors, it must not be forgotten that this is also a task for the doctors. It implies: the protection of the persons from invisible enemies; the protection of friendly troops handling bacterial weapons; the conferring of effective immunity on friendly troops face to face with bacteriological warfare employed by the enemy. All kinds of protective arrangement and preventive measures must therefore be included in the research program.

Since the meeting just described, the research has not only progressed rapidly, but has accomplished considerable achievements.

The use of plant materials, such as burdock, carrot, ginkgo, etc., and animal materials, such as egg-yolk, fish-powders, etc., as additional agents in culture media for growing bacteria, has not only decreased the minimal lethal dose required to kill small animals to less than one third, but has also increased the virulence. In general, the incubation period before the inoculated animals develop symptoms of infection is 2-4 days. After two successive passages through animal bodies, it has proved possible to produce with certainty symptoms of infection within 48 hours.

(2) PLAGUE BACILLI AS A WEAPON

The bacillus of bubonic plague was studied by Major Sitanaka. Although the resistance of the organism itself is not great, but the reaction produced by its invasion of the human body is so severe that hardly any other disease can be mentioned in comparison with it. Furthermore, the portals of entry are many. It produces plague of pneumonic type if it comes in through the respiratory tract, that of skin or bubonic type if through the skin and that of ophthalmic type through the eyes. The course of the disease is acute and rapid. The patient may die within a few hours or at the latest a few days. The mortality rate is 100%. This is the most effective agent for bacteriological warfare. It fulfills the

requirements of a weapon except that great care has to be taken in its manipulation. It can not be made into dusts but there are many ways of dispersing it. When used at the front, it may be mixed with the projectiles inside the shrapnel shells and dispersed through bombing, or it may be made into a suspension and spread by spraying. As the bacteria also attack the rodents and invade human beings from the rodents, through fleas as the intermediate hosts. It may also be dispersed by dropping rats and voles previously infected with the bacteria by injections using special methods such as parachute containers; or by dropping bacteria-laden fleas, which disperse bacteria by biting rodents and man.

(3) CULTIVATION OF FLEAS

It is well known that fleas transmit not only plague but also relapsing fever and typhus fever. Since the plague bacillus is the most effective bacteriological weapon, the study of the entomologist Hatano on the feeding and cultivation of fleas may be considered as one of the most important pieces of work done. After extensive and intensive study of the feeding material, cultivation arrangements, and optimum temperature, he finally succeeded in cultivating large number within a very short period.

In summer, the survival period of fleas which have sucked blood is more than 40 days, while those which have not sucked survive about two weeks. In winter, it is said that they can live also more than one month even if they have not sucked blood. Each female flea deposits about 8-10 eggs at a time, and about 800 eggs in all throughout its whole life.

In ordinary houses, eggs are laid inside the crevices of tatami (a kind of Japanese bed matting made of straw) and the floor. After a period of 2-6 days in summer, or of 12 days in winter, the egg hatches out and the larva emerges. The larva takes 10-12 days to change into the pupa, and it takes another 12 days to reach the stage of adult fleas. So, from egg to adult a flea needs 4-6 weeks for its natural development. But after the detailed studies by Hatano on the influence of temperature and food on growth, maximum production may be obtained within 4 weeks.

The method is to select a petroleum can with no rust inside. The top piece is taken off and the inside is filled with equal amounts of seed coats of millet and sand up to a level 6 inches from the top as the flea cannot jump higher than 6 inches. Two couples of healthy fleas, both male and female, which have been made resistant to insecticide such as pyrethrum etc. are then introduced. In addition, 5 more females are put in. Then a large white Norwegian rat in a wire cage is placed in the can to serve as food for these fleas. If it dies, a new one is substituted for it. The can is then put in a shady place and the inside temperature

adjusted. The fleas are collected when they have multiplied to their maximum.

(4) PORCELAIN BOMB

The raw materials of porcelain (such as any kaolin, clay etc.) are plentiful, and the bomb is easily made in any ordinary porcelain kiln. Its application is wide indeed. There are two kinds: one weighs 4 kgs. and the other 2. The characteristic point is that it contains very little explosive gunpowder but readily breaks into small pieces of less than 1 cm. each, which scatter widely. The diameter of the dispersal area is about 100-120 meters for the larger kind of bomb and 30-60 meters for the smaller one. Furthermore, this kind of bomb can be made to explode on touching the ground or in the air on the enemy side. The capacity of this bomb is quite considerable; the larger one contains about 4 kgs. of the bacterial substance and the smaller one about 2 kgs. Since meat broth is used as the base of the bacterial suspension, bacteria will continue to grow even after having been transferred to the bomb. Moreover, certain kinds of bacteria produce gases during their growth so that in a bomb carrying such kinds of bacteria, the explosive power will be increased by the expansion of these contained gases.

The porcelain bombs carrying tetanus and anthrax bacilli are suitable for use at the front. Those carrying typhoid, dysentery and anthrax bacilli are suitable for use in attacking troops concentrated in the rear. The use of fleas carrying plague bacilli has been proved effective experimentally. When the fleas are introduced into a bomb, oxygen must be passed in so as to prevent inactivation of the fleas under low oxygen tension if the airplane should fly at a high altitude.

There is, moreover, another kind of bacterial bomb, i.e., the shrapnel bomb or shell. This container is wholly made of metal and is filled inside with pieces of metal. These projectiles, each about 5 cm. in diameter, are coated with different kinds of wound-infecting bacteria (such as *C. tetani C. perfringens and B. anthracis*) as also plague bacilli to infect the wounds produced by the shell. This is to be used at the front. Since it contains a limited amount of explosive agent, it explodes only on touching the ground. The shell fragments and shrapnel projectiles will cover an area of about 40 meters in diameter.

(5) ATTACK BY USING SPRAYS AND SHOWERS

The apparatus used both in sprays and showers are made of light metal. They are mounted in the airplane. The spraying apparatus consists of a large tank with a capacity of 500 litres to which about 20 sprayers are connected. The spray is effected by compressed air during the

flight of the airplane. The fine droplets of the spray thus form a bacterial "mist" leaving behind the plane in the form of a band of cloud. The showering apparatus consists of a large cylindrical tank perforated with numerous small holes. Through these holes the shower of the fluid containing bacteria is made intermittantly. The fluid containing the bacteria has a rather high specific gravity. In this way the fluid not only provides the nutritional requirements of the bacteria but also increases the rate of sinking of the droplets to the ground. These purposes are generally effected by using nutrient broth.

The spraying method of bacterial attack makes use of the plague bacilli and anthrax bacilli. The method is chiefly used in the front of the battle field. It is also used effectively to cut the communication line between the front and the back.

The showering method of bacterial attack is applicable for the cholera vibrios, the dysentery bacilli, and the typhoid bacilli. It is used to attack the source of water supply, military concentrations at the rear or military supply grounds.

Besides, there is also a method, called dusting, in which case powdered anthrax bacilli and typhoid bacilli are spread over the front or at the rear. It is said that this method is most suitable for spreading of bacteria to destroy agricultural plants of the enemy country.

The spreading of fleas infected with plague bacilli can also be effected by putting them in a tank inflated with oxygen. Experiments in this respect showed that about one third of the fleas so treated will die, but the remaining still retain their jumping power on reaching the ground.

(6) THE SELF-DESTROYING PAPER CONTAINER

The container (Figure 4) is a strong paper cylinder which can split open along the middle. The cavity of the cylinder is divided into 2 or 3 compartments. It has a paper or rayon parachute attached to its head, and a heavy weight and detonator below; and there is a fine fuse connection between the detonator and the parachute.

Twelve domestic rats and six wild rats, all infected with plague bacilli, are put in the paper cylinder. At the same time fleas carrying bacteria after feeding on these animals are wrapped in thin paper packages and put in the cylinder.

After being dropped from the air behind the enemy's lines, or over his military stations and bases or important cities, the paper cylinder splits into two pieces on touching the ground or before. The small animals and fleas in the cylinder immediately disperse. The detonator

under the cylinder then sets fire to the container and the fuse so that both the cylinder and parachute are burnt up without leaving any trace.

It may also be anticipated that parachute alone can be used to drop bacteria-laden foods as weapons near isolated enemy's stations. For such a purpose, advantage can often be taken of cloudy weather, or it may be accomplished by using an "insignia changer" on the airplane in order to disguise as one of the enemy's own planes.

The insignia changer is an arrangement enabling a free and rapid interchange between our own and the enemy's insignia operated from the pilot's seat. It is necessary for bacteriological warfare, especially when attacks with such weapons are carried out over enemy territory to destroy his crop and plants, this arrangement makes it possible to accomplish such a purpose safely in the daytime over the heads of people who are ignorant of the exact shapes of airplanes.

(7) THE FLOATING BOTTLE

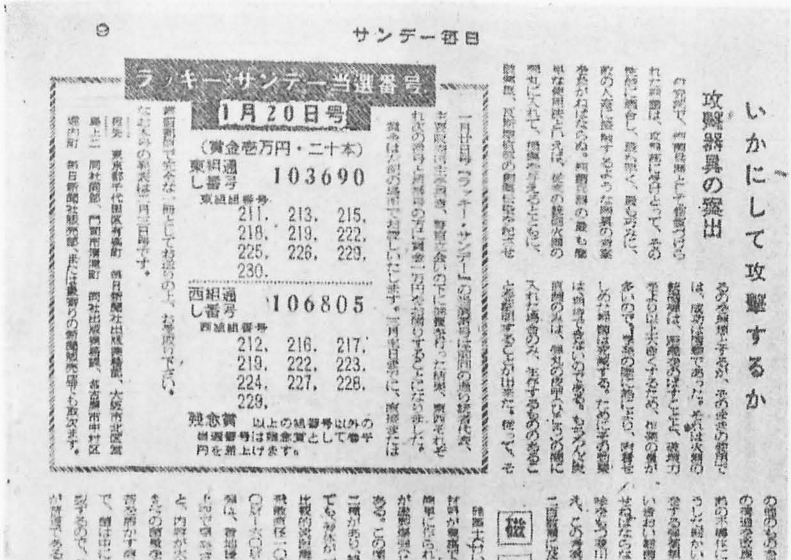
The floating bottle is a long necked flask of about 5 litres capacity. The bacterial suspension is put into the flask, the mouth of which is provided with explosive as well as a clock-like timer. The bottle is so managed that when put in water only the mouth of the bottle is exposed above the water surface. This bacterial apparatus is used to attack streams, swimming grounds at the sea sides, and dockyards in which vessels are gathering. It is also used in special conditions of the battle. For instance when the combating forces of both sides are located on the banks of a river, and one side is on the upper stream while the other is on the lower steam, the former, having ascertained that the enemy is using the river water for drinking and bathing purposes, the floating bottle can be used. The velocity of the stream is determined, the clock-like timer is properly set so that when the bottle reaches the enemy front by floating, it explodes. The content of the bottle is set free and the stream water is contaminated. In the case of sea water the speed and the direction of the tide should be determined before this method of attack is applied.

Dysentery bacilli, typhoid bacilli and cholera vibrios are used in bacterial attacks for river water, while the cholera vibrios are most suitable for sea water.

Literature concerning bacteriological warfare, published in the Japanese magazine "Sunday Mainichi", Jan. 27, 1952 (Figs 1-4), and photograph of Ishii earthenware bombs (Fig. 5)

Fig. 1. Front page in Sakaki Ryohei's article, "Bacteriological Warfare".

Fig. 2. Diagram of the shrapnel bomb as shown in the original article.



いかにして攻撃するか

攻撃器具の案出

磁製爆弾

噴霧雨下

ラッキー・サンデー当選番号

1月20日号

（賞金壱万円・二十本）

東組通し番号 103690

東組組番号

211, 213, 215, 218, 219, 222, 225, 226, 229, 230.

西組通し番号 106805

西組組番号

212, 216, 217, 219, 222, 223, 224, 227, 228, 229.

残念賞　以上の組番号以外の当選番号は残念賞として壱千円を差上げます。

第三図　磁製爆弾

Fig. 3. Diagram of the porcelain bomb.

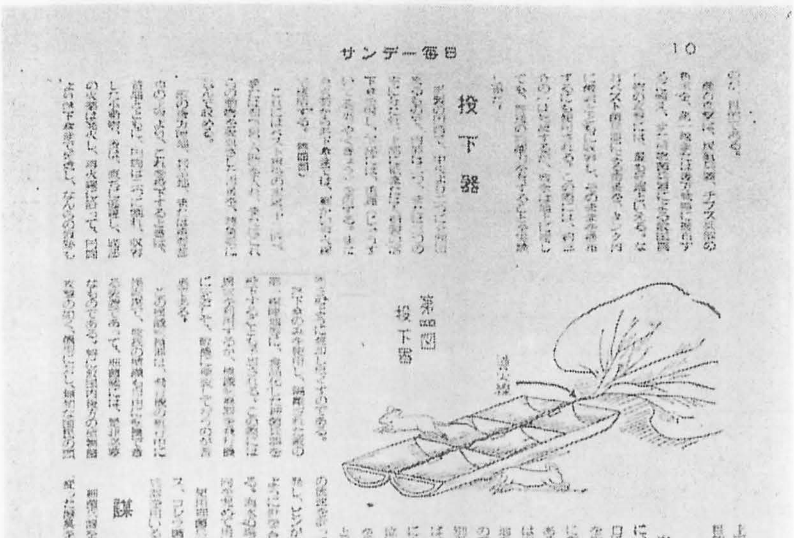


Fig. 4. The self-destroying paper cylinder.

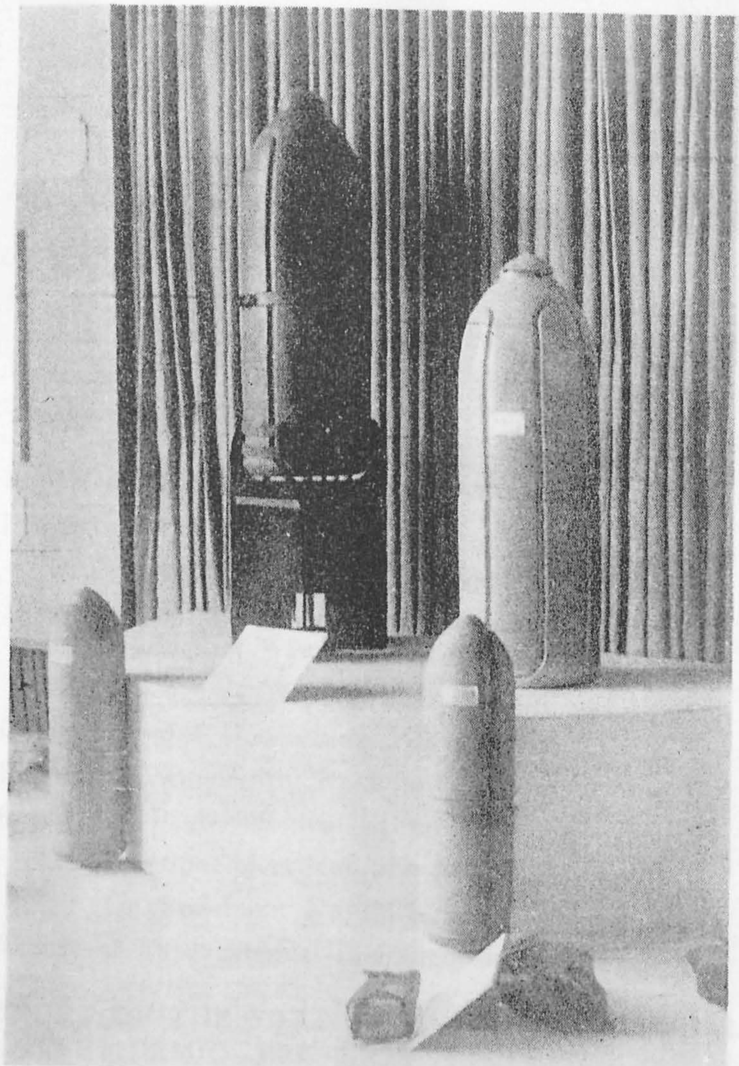


Fig. 5. Samples of Ishii earthenware bombs collected from the ruins of the factory near Harbin where they were made during the second world war.

APPENDIX R

Report on a Case of Plague in Kang-Sou Goon, Pyong-An-Nam Do, Caused by Contact with Fleas Infected with Plague and Dropped by a U.S. Military Plane on March 25, 1952

(ISCK/2)

CONTENTS

I. REPORT OF THE FIELD ACTIVITIES OF CENTRAL EPIDEMIC PREVENTION CORPS

To the Minister of Health:

Report on the Occurrence of a Case of Plague in Kang-Sou Goon, Pyong-An-Nam Do.

1. On April 2, 1952, Pak Yun-Ho, a villager in the upper village of Kang-Sou, fell ill with the symptoms of headache and chills. The patient was isolated in an individual lodge on April 3. The family of patient was then disinfected and all the houses in the village were also disinfected.

2. An anti-rat campaign was carried out using rodenticides and wire-traps. 143 rats were caught throughout the upper and lower villages. Autopsy findings on 23 rats revealed no remarkable change, and smears of their organs failed to show any kind of bacteria.

3. Medical inspection and measurement of body temperatures were carried out in every house.

4. Patient Pak Yun-Ho died in the evening of April 4, 1952. Autopsy was done on April 6, internal organs of the corpse were sent to laboratory for histological examination. Smears were prepared from the internal organs of the corpse, and post-mortem materials were inoculated on agar-slants. These smears and agar-slants were sent to the laboratory for bacteriological examination. Bacteriological examination revealed that the patient Pak Yun-Ho died of plague.

5. According to the statistics given by the Goon-Health-Department, only a few cases of relapsing fever, diphtheria and measles were reported in the district from Jan. 1 to Apr. 1, 1952. Information obtained from the villagers confirmed that there had been no other infectious disease in this village.

No epizootic among rodents had ever been reported.

6. On Mar. 25, 1952, Pak Yun-Ho, a villager in the upper village, found fleas floating on the water surface in a water jar. The chairman of the Village People's Committee informed the Goon-Health-Department of this fact. The Epidemic Prevention Corps of the Goon carried out disinfection and investigation in the district. 20 fleas were sent to the laboratory of the Central Sanitary and Epidemic Prevention Station for examination, and the rest were burned on the spot. Bacteriological examination of these fleas revealed *Pasteurella pestis.*

7. Information obtained from the villagers revealed that American planes flew over this district on many occasions; and in the night between 24th and 25th of March an American plane circled over this region. The villagers and the village Home Guard did not see the fleas dropping from the sky, but, taking into consideration that infected fleas were found in the water jar, it could only be that the above mentioned fleas were dropped by the American plane.

8. On the basis of the results obtained by epidemiological and bacteriological examinations, we reach the conclusion that the occurrence of the plague case in Kang-Sou Goon was caused by the fleas dropped by the American plane. Activities in the quarantined district are still in operation.

Choi Hyun-Soo (Signed)
Chief, Mobile Epidemic Prevention Corps.
April 17, 1952

1. Report of the Field Activities of Local Epidemic Prevention Corps

To the Director of the Health Department, People's Committee of Kang-Sou Goon, Pyong-An-Nam Do:

On receipt of your instructions at about 8:30 a.m. Mar. 25, 1952, to proceed to Kum-Song Li, Sung-Tai Myon, where an American plane had dropped fleas, to carry out investigations and eradicate them, I immediately went to the place with two members of the Mobile Epidemic Prevention Corps (MEPC). We arrived there at about 12 noon Mar. 25, 1952. Under the guidance of Choi Ryong-So, Chairman of the Village Epidemic Prevention Committee, and Song Chang-Won, an eye-witness, we arrived at the spot without difficulty and carried out investigations and epidemic prevention activities as follows:

1. Condition of the scene:

(a) Dozens of fleas were found floating on the surface of water in a water jar of 50 cm. in diameter. The water jar was located 4 meters northeast of the well which was situated about 80 meters northeast of the residential district in the village of Kum-Song Li.

(b) No container was found.

2. Collection of specimen:

Twenty fleas were collected from the water jar with sterile pincers and put into a sterile test-tube, which was then tightly plugged with sterile cotton and wax, and sent to the laboratory of the Central Sanitary and Epidemic Prevention Station (CSEPS) for examination.

3. Epidemic Prevention Activities:

(a) The area where the fleas had been dropped was quarantined and the village home guard was charged with the task of cutting off all communications.

(b) After collection of specimens, the area surrounding the well and the vicinity were disinfected with 6% hexachlorane and 3% phenol. All the remaining fleas were burned and buried.

(c) The neighbouring houses were thoroughly disinfected. Thorough cleaning, anti-rat campaign and anti-insect campaign were extensively carried out. 120 rats were caught and burned. People were forbidden to use the well.

(d) A health campaign was widely carried out. All villagers were inoculated against plague.

(e) Strict medical inspection was conducted daily.

4. Investigation on dissemination of insects:

According to information obtained from eye-witnesses Song Chang-Won, Choi Ryong-So and other villagers, an American plane circled very low over this place at about 4 a.m., Mar. 25, 1952, without strafing or bombing.

5. The Epidemic Prevention Corps is still continuing its activities with the help of reinforcements despatched from the Central Sanitary and Epidemic Prevention Station.

Den Moon-Sun, (Signed)
Chief of the MEPC of Kang-Sou Goon.
March 31, 1952.

2. Record of Witness Song Chang-Won

Address: Kang-Sou Goon, Pyong-An-Nam Do.
Name: Song Chang-Won. Sex: male. Age: 32
Occupation: peasant.

In the morning of March 25, 1952, I went to Pak Yun-Ho's house to consult with him on farming. There I found Pak Yun-Ho returning from the well where he had gone to wash his face. He said there were many fleas floating on the surface of water in a water jar. We went together to the well situated about 80 meters from our houses. I found fleas floating as if dead on the surface of water in the water jar near the well. This reminded me of the fact that at about 4 a.m. this morning an American plane had circled at low altitude without strafing or bombing. I thought these fleas had been dropped by the American plane, and I informed the Village People's Committee of this fact.

Pak Yun-Ho said he had filled the water jar with fresh water the night before.

Song Chang-Won (Signed)
March 25, 1952

3. Record of Witness Pak Yun-Ho

Address: Kang-Sou Goon, Pyong-An-Nam Do.
Name: Pak Yun-Ho. Sex: male Age: 26.
Occupation: peasant.

At about 4 a.m. March 25, 1952, I was awakened by the roaring of an American plane circling at low altitude. The enemy plane flew

away after circling several times without strafing or bombing. I couldn't sleep again after this. I got up around 6 o'clock in the morning and went to the well situated about 80 meters northeast of my house to wash my face. There I found dozens of fleas floating on the surface of water in a water jar which was about 4 meters east of the well. I had filled this water jar with fresh water the previous night. I was surprised at this sight. I hurried back home and took my neighbour Song Chang-Won to the well. Song Chang-Won and I thought that these numerous fleas floating on the surface of water must have been dropped by the American plane circling over our village before dawn. We, therefore, immediately informed the chairman of the Village People's Committee of this incident.

Pak Yun-Ho (finger-printed)
March 25, 1952.

II. CLINICAL RECORD CONCERNING PAK YUN-HO

Name of patient: Pak Yun-Ho Sex: male, Age: 26,
Occupation: peasant.
Address: Kang-Sou Goon, Pyong-An-Nam Do.
Date of onset of illness: April 2, 1952 (9 a.m.)
Tentative diagnosis: Acute febrile infectious disease.
Final diagnosis: Septicemia following bubonic plague, right inguinal.
Date of death: 11:30 p.m. April 4, 1952.

Chief complaints: Headache, chills and high fever.
Past history: Healthy. Had an attack of malaria in summer of 1951. Received cholera-typhoid-paratyphoid-dysentery mixed vaccine on March 12, 1952.

Personal and contact history: Patient was born and brought up in his native place. Had not travelled to other places, no visitor came to stay overnight in his house during the past month. In the early morning of March 25, 1952 he discovered many fleas floating on the surface of the water in a jar near the well from where he drew water; he immediately reported this to local anti-epidemic organization. An American plane had circled over this village in the night of March 24th, 1952.

Present illness: In the early morning patient felt some weakness. He suddenly developed chills, high fever and severe headache and general soreness after breakfast.

Physical examination: Body temperature 39°C, pulse 100/min. and respiration 23/min. Well-developed and moderately nourished. Men-

tally clear. Conjunctivae congested. Lips dry. Tongue whitely coated. Throat negative. Skin dry and hot but no rashes found. Neck soft. Chest revealed no abnormal findings. Heart sound accentuated. Abdomen not tender. Spleen and liver not palpable. There was no general glandular enlargement. Knee jerk present, Babinski's sign negative. White cell count 15,000/cmm. with 85% P.M.N., 14% lymphocytes and 1% monocytes. No parasites or spirochetes found in the blood smear.

Treatment: Sulfadiazine 2 gm. stat, followed by 1 gm. q. 4 h. Patient was isolated.

Impression: Acute febrile infectious disease.

Choi Hyun-Soo, M.D.

April 2, 1952.

Progress Note

Yesterday patient did not sleep well. Appetite impaired but thirsty. Fever persisted. Restless but clear. Conjunctivae markedly congested. Temp. 39.5-40°C, pulse 135/min, resp. 25/min. Lips dry. Tongue thickly coated. Skin showed no rashes or hemorrhagic spots. Examination of chest and abdomen still revealed no particular change. Right inguinal lymph nodes and right axillary lymph nodes enlarged and tender. Neck soft. Reflexes exaggerated. Babinski's sign negative. Had diarrhea once. Urine scanty. White cell ccunt 22,000/cmm. with 88% P.M.N. and 12% lymphocytes. Blood smear again was negative for parasites or spirochetes. Treatment consisted of sulfadiazine 1 gm. q. 4 h., and 1,000 ml. of glucose saline intravenously.

Choi Hyun-Soo, M.D.

9 a.m. April 3, 1952.

Patient was examined again at 1 p.m. on the third day of illness. His general condition became critical. Mentality gradually became cloudy with delirium at times. Lips slightly cyanotic. Vomited once at 10 a.m. with greenish yellow colored fluid vomitus. Passed one loose stool. Examination of chest revealed accentuation of breathing sounds but no rales. Abdomen full, no tender spots. Liver and spleen still not palpable. Right inguinal lymph nodes enlarged with severe pain and tenderness. There was no inflammation to be seen in the lower part of the right lower extremities. Axillary lymph nodes still tender. Heart sound accentuated but irregular. Body temperature of patient suddenly dropped and died at 11:30 p.m.

Tentative diagnosis: Bubonic plague with secondary septicemia.

Autopsy was requested for confirmation of diagnosis and cause of death.

Choi Hyun-Soo, M.D.
11:40 p.m. April 4, 1952

III. REPORT OF PATHOLOGICAL EXAMINATIONS

Name: Pak Yun-Ho Sex: male Age: 26
Occupation: Peasant, Domicile: Kang-Sou Goon, Pyong-An-Nam Do.
Date of onset of illness: 9 a.m., April 2, 1952
Date of death: 11:30 p.m., April 4, 1952.
Date of autopsy: 10:00 a.m. April 6, 1952
Prosector: Chang Wun-Yung.

Pathological Anatomical Diagnosis

1. Acute necrotizing lymphadenitis with acute hemorrhagic, necrotizing perilymphadenitis (right inguinal); acute hemorrhagic lymphadenitis, axillary, (bubonic plague).
2. Terminal septicemia following primary bubonic plague.
3. Pulmonary edema and congestion with subpleural hemorrhage.
4. Enlargement of spleen and liver.
5. Dilatation of the right ventricle of heart.
6. Congestion of internal organs with hemorrhage (especially spleen and liver).
7. Postmortem change of internal organs.

External Examination

The body was about 170 cm. in length, well developed but moderately nourished. Skin was dark greyish with presence of livor mortis over the dependent parts. Rigor mortis was found in the extremities. Pupils were dilated and equal. Conjunctivae were congested but no jaundice. There was no discharge found in the mouth cavity, nostrils and ear canals. Skin over both inguinal regions revealed no change of note, but the lymph nodes in the right side were palpable. Chest was symmetrical and abdomen was flat. External genitalia showed no particular change.

Examination of Body Cavities

Chest cavity: Neither chest cavities showed adhesions or fluid. The lungs in both sides were voluminous and dark red in color. Pericardial sac showed no particular change. The height of diaphragm was

at the 5th rib on the right side and at the 5th intercostal space on the left side.

Abdominal cavity: There was no free fluid or adhesion in the abdominal cavity. Intestinal loops were slightly distended with gas. The liver and spleen were found to be enlarged. Peritoneum was smooth but with presence of few hemorrhagic spots.

Examination of Internal Organs

Heart: Epicardium was smooth and epicardial fat was reduced in amount. Right ventricle was slightly dilated containing large amount of postmortem blood clot. Endocardium as well as valves showed no remarkable change. Heart blood was taken for inoculation of agar slant and smear.

Lungs: Both lungs were voluminous and their free surfaces were smooth. There was no palpable consolidation but some emphysematous change at periphery. On section, their cut surfaces were purplish red in color with frothy fluid running out on pressure. Mucous membrane of bronchus was red in color and covered with mucus. Hilar lymph nodes were not enlarged. Blood from lung was taken for inoculation of agar slant and smear.

Liver: It was enlarged with round edges. Its free surface was smooth. On section, it was soft showing postmortem change but the color of the cut surface was dark red. There was no necrotic foci found on the cut surfaces. Gall bladder showed no change of note. Blood was taken from liver for inoculation of agar slant and smear.

Spleen: It was enlarged and very soft in consistency. Its capsule was smooth. On section, the cut surface was pasty in appearance and dark purplish in color, but there was no necrotic foci seen. Blood was taken for inoculation of agar slant and smear.

Stomach: It was dilated containing moderate amount of digested food. Mucosa as well as submucosa showed no particular change.

Intestine: No particular change. Mesentery lymph nodes were slightly enlarged, about 1 cm. in diameter.

Kidneys: Capsules could be stripped off with ease. Surface was smooth. Cut surfaces showed postmortem change and dark red in color. Pelves showed no change.

Urinary bladder: No change.

Lymph nodes: The right inguinal region was cut open and the perinodular tissue was found to be hemorrhagic. The nodes were

enlarged with a diameter about 1.5 cm. They were matted together and a few of them showed some hemorrhage on their cut surface. Tissue from the cut surface was taken for inoculation of agar slant and smear.

Both axillary regions were cut open and the lymph nodes with the surrounding fibro-adipose tissue were found to be hemorrhagic. The largest node measures about 1.0 cm. in diameter.

Specimens consisting of heart, lungs, liver with gall-bladder attached, spleen and kidneys and right inguinal and axillary lymph nodes were sent to the laboratory of the Central Sanitary and Epidemic Prevention Station (CSEPS) for histopathological examination. Five inoculated agar slants and smears were sent to the laboratory of CSEPS for bacteriological examination.

Prosector: Chang Wun-Yung (signed)
CSEPS
April 6, 1952.

Microscopic Examination

Specimens (No. 371-3) consisting of heart, lungs, spleen, liver with gall-bladder, kidneys, right inguinal lymph nodes and axillary lymph nodes were received on April 6, 1952 for histopathological examination. They had already been fixed in formalin, but they showed marked postmortem change, probably due to delayed autopsy. Selected tissue blocks were taken from different organs as well as lymph nodes for histological sections. Stains used for these sections were hematoxylin-eosin, methylene blue, carbothionin and Gram's stain for histological changes and differentiation of micro-organisms.

Right inguinal lymph nodes: Lymphoid follicles are entirely dissociated or have disappeared. Areas of necrosis swarmed with groups of Gram-negative bipolar stained bacilli, seen also in some parts of the section especially at the periphery. Infiltration of large number of polymorphonuclear leucocytes, mononuclear cells and lymphocytes is found in the lymphoid tissue especially around the groups of bacilli. In the non-necrotic areas there is swelling of reticulo-endothelial cells. Sinuses are dilated and filled with some mononuclear cells. Capsule of the lymph node is loose and infiltrated with some mononuclear cells in certain parts. The fibro-adipose tissue peripheral to the node shows necrosis and congestion with hemorrhage. In these necrotic areas groups of Gram-negative bipolar stained bacilli are also found, and the infiltration of leucocytes is also seen.

Axillary lymph nodes: Lymphoid follicles are entirely absent. Congestion with hemorrhage is seen in the lymphoid tissue especially in the subcapsular region. Lymphoid sinuses are dilated. Throughout the section there is infiltration of mononuclear cells. No bacilli are found in section stained with Gram's stain, methylene blue or carbothionin. Capsule appears to be loose and congested, and it is infiltrated with a few round cells. The fibro-adipose tissue peripheral to the node shows congestion.

Heart: Epicardial fat is reduced in amount. Muscle fibers of the myocardium show slightly atrophic change. The interstitial tissue is slightly congested.

Lung: There is marked congestion with slight hemorrhage in spots in the subpleural region. The parenchymatous tissue shows edema and some congestion. Small bronchus shows dilatation of lumen with desquamation of lining epithelial cells. No bipolar stained bacilli are found in the section.

Spleen: There is marked post-mortem change, but severe congestion and focal hemorrhage in the subcapsular region is seen. Lymphoid follicles are reduced in size and number. Infiltration of some large mononuclear cells is observed in section. In the trabecular vein and red pulp there are present a few Gram-negative bipolar stained bacilli.

Liver: Postmortem change is severe and therefore, no special change could be found, except there is congestion with spotted hemorrhages.

Kidney: Postmortem change and congestion.

Stomach and small intestine: No particular change except congestion.

Conclusion

The essential finding in this particular case is acute necrotizing lymphadenitis and hemorrhagic necrotizing perilymphadenitis with presence of Gram-negative bipolar stained bacilli. The latter, few in number, are also seen in the trabecular vein and red pulp of spleen. While the internal organs such as spleen and liver show congestion with hemorrhage, the lungs also show edema in addition to subpleural hemorrhage. The reticulo-endothelial cells of the lymphoid tissue showed swelling. In addition, *Pasteurella pestis* organisms have been isolated from the right inguinal lymph node as well as the internal organs (lungs, spleen and liver), and heart blood. The changes stated above can be explained on the basis of bubonic plague followed by the dissemination of the micro-organisms throughout the blood

stream. The cause of death of the patient is septicemia following bubonic plague.

Nam Chang-Choon, M.D.
Pathologist, CSEPS
April 30, 1952.

IV. REPORT OF BACTERIOLOGICAL EXAMINATIONS

(1) On Specimen No. 331-32

No. of Specimen: 331-32
Name of Specimen: 20 fleas.
Date of Collection: March 25, 1952.
Date of Receipt of Specimen: March 26, 1952.
Location of Collection: Kang-Sou Goon.
Date of Examination: Mar. 26-Apr. 15, 1952.

Examination and Results

Twelve fleas were washed in sterile saline three times, ground in a sterile mortar and emulsified with 3 ml. of sterile saline.

1. Microscopic Findings:

Smears made from this emulsion were stained with Löffler's methylene blue and Gram's method. Few Gram-negative bipolar stained bacilli were found.

2. Animal Test:

1 ml. of this emulsion was injected subcutaneously into the right lower abdomen of the guinea pig No. 23. The guinea pig died 6 days later.

(1) Autopsy findings: Local inflammation with haemorrhage and edema in the surrounding tissue was observed at the site of inoculation. Inguinal lymph nodes were enlarged and congested on both sides. The cut surface of the right one showed hemorrhagic and necrotic changes. Spleen was markedly enlarged, showing whitish miliary necrosis over the whole organ. Liver was swollen and congested. Heart showed no gross change, lungs were congested.

(2) Microscopic findings: Smears made from heart blood, spleen, liver and inguinal lymph node were stained with methylene blue and Gram's method. Gram-negative bipolar stained oval-shaped bacilli were found on smear.

3. Cultural Examination:

A pure bacterial strain was isolated from the heart blood of this guinea pig No. 23.

(1) Cultural characteristics.

Colonies of this pure bacterial strain incubated at 30°-32°C for 48 hours were small in size. They were greyish white under reflected light, bluish gray and semi-translucent through transmitted light. Examined under the microscope at a magnification of 100x, the colonies appeared to have a dark granular surface. The central part of the colony was raised and the periphery was irregular and thinned out. Meat infusion broth tubes inoculated with the single colony when incubated at 30°-32°C for 48 hours, showed no turbidity. The broth remained clear with floccular and granular growth at the bottom of the tube.

(2) This pure bacterial culture showed the following biochemical reactions:

a) Glucose, maltose and mannite showed acid reaction without gas formation.

b) Lactose, saccharose, rhamnose, sorbitol and adonitol remained unchanged.

c) Indol was not produced.

d) The organism was non-motile.

(3) Serological reactions:

a) Heat precipitation test: Positive.

b) Agglutination test: Positive with the end titre of 1:160.

(4) Bacteriophage susceptibility test: Positive.

4. Animal Skin Test:

One loopful of this isolated pure culture of 48 hours' growth on plain agar slant was smeared over the shaven skin of the right lower abdomen of guinea pig No. 24. On the 6th day after inoculation the guinea pig died.

(1) Autopsy findings: Local hemorrhagic necrosis, adhesion and edema of the surrounding tissue were found over the shaven region of abdomen. Bilateral inguinal lymph nodes were swollen and congested. The right one was markedly enlarged and its cut surface showed hemorrhagic and necrotic changes. Liver swollen and congested. Spleen

markedly enlarged showing whitish miliary necrosis over the whole organ. Lungs and heart showed no gross changes.

(2) Microscopic findings: Smears made from heart blood, spleen, liver, and inguinal lymph node were stained with methylene blue and Gram's method. Gram-negative bipolar stained, oval-shaped bacilli were found on smear.

(3) The pure bacterial strain isolated from the heart blood of guinea pig No. 24 showed the same cultural characteristics and biochemical reactions as the pure culture used in this animal test. The heat precipitation test, the agglutination test and also the bacteriophage susceptibility test of this strain were all positive.

Conclusion

Pasteurella pestis was found in the specimen examined (labeled No. 331-32).

Ri Yu-Kyu, M.D.
Bacteriologist, CSEPS
April 16, 1952

(2) On Specimen No. 371-39

No. of Specimen: 371-39

Name of Specimen: Five inoculated agar-slants from postmortem materials of Pak Yun-Ho: heart blood, lymph node, spleen, liver, and lung tissue; and ten smears made from these organs.

Date of Collection: April 6, 1952.

Date of Receipt of Specimen: April 6, 1952.

Location of Collection: Kang-Sou Goon, Pyong-An-Nam Do.

Condition of Specimen:

a. Five inoculated agar slants were kept in a long tin container.
b. Ten slide smears were kept in a wooden box.

Date of Examination: April 7 – April 26, 1952.

Examinations and Results

1. Microscopic Findings: The ten smears obtained were stained with Gram's and Löffler's methods. Gram-negative bipolar stained bacilli were found on smear, most numerous in heart blood.

2. Cultural Examination:

The five agar slants obtained were incubated at 30°-32°C for 48 hours. The colonies grown on the agar were small, greyish white,

slightly elevated. Besides these, many big colonies which were opaque and white in color were found. A single small colony was picked out from the agar-slant of heart blood and inoculated onto a blood agar plate for pure culture.

(1) Cultural characteristics:

After 48 hours' incubation at 30°-32°C, small sized, slightly elevated colonies were found. They were grayish white under reflected light, bluish gray and semitranslucent by transmitted light. Examined under the microscope at a magnification of 100x, the colonies appeared to have a dark granular surface. The central part of the colonies was raised and the periphery was irregular and thinned out. Meat infusion broth tubes inoculated with a single colony when incubated at 30°-32°C for 48 hours, showed no turbidity; the broth remained clear with floccular and granular growth at the bottom of the tube.

(2) The pure culture of this single colony showed the following biochemical reactions:

a. Glucose, maltose, and mannite showed acid reaction without gas formation.

b. Lactose, saccharose, rhamnose, sorbitol and adonitol remained unchanged.

c. Indol was not produced.

d. The organism was non-motile.

(3) Serological reactions:

a. Heat precipitation test: positive.

b. Agglutination test: positive with the end titre of 1:160.

(4) Bacteriophage susceptibility test: Positive.

3. Animal test: One loopful of pure culture of 48 hours' growth on plain agar slant was smeared over the shaven skin of the right lower abdomen of guinea pig No. 38. On the 5th day after inoculation the guinea pig died.

(1) Autopsy findings: Local hemorrhagic necrosis with subcutaneous edema and exudate was seen over the shaven region of abdomen. Both inguinal lymph nodes were swollen and congested with periadenitis. The right one was markedly enlarged and its cut surface showed hemorrhagic and necrotic changes. Liver was enlarged and congested. Spleen was markedly enlarged and numerous miliary necrotic foci were found over the whole organ. Lungs were congested.

(2) Microscopic findings: Smears made from heart blood, lung, liver, spleen and lymph node were stained with methylene blue and Gram's method. Gram-negative bipolar stained oval-shaped bacilli were found on smears.

(3) The pure bacterial strain isolated from the heart-blood of the guinea pig No. 38 showed the same cultural characteristics and biochemical reactions as the pure culture used in this animal test. The heat precipitation test, the agglutination test and also the bacteriophage susceptibility test of this strain were all positive.

Conclusion

Pasteurella pestis was found in the specimens examined (labeled strain No. H-21).

Ri Yu-Kyu, M.D.
Bacteriologist, CSEPS
April 27, 1952

V. REPORT OF ENTOMOLOGICAL IDENTIFICATION

Name of Specimen: Fleas.
Specimen No.: 331-1
Date of Collection: Mar. 25, 1952
Date of Receiving: Mar. 26, 1952
Collector: Den Moon-Sun.
Locality of Collection: Kang-Sou Goon, Pyong-An-Nam Do.
Condition of Packing: The fleas were kept in a test tube with tight fitting bung.

Identification:

No. 331-1 Human flea—*Pulex irritans*
Family: Pulicidae
Order: Siphonaptera

Kim In-Wan (Signed)
Entomologist, CSEPS
Mar, 28, 1952

APPENDIX S

Hearings on the Kang-Sou Incident (Plague); Replies of Eye-Witnesses and Statements by Scientific Experts

The [redacted] Korean Minister of Health (Dr. Ri Ping-Nam) stated that no plague had been recorded for five centuries in Korea, north or south, either under the Ri dynasty or the Japanese. Only in 1952 there began to have cases, always associated with the appearance of plague-infected fleas after the invasion of American planes. The Korean health authorities had therefore no previous experience in plague work, but they had been greatly assisted by the arrival of outstanding Chinese plague experts such as Dr. Ch'en Wên-Kuei, who had given most valuable aid.

[It will be remembered that Dr. Ch'en was the author of the report on plague disseminated by the Japanese at Changteh during World War II, reproduced as App. K].

Eye-Witnesses

1)	Song Chang-Won	farmer
2)	Pak Yun-Ok	sister of Pak Yun-Ho, the victim
3)	Choi Ryong-So	farmer, head of the village

1) Song Chang-Won confirmed his testimony as given in the Report (App. R).

(M) Could not say how far the zone thick with fleas extended around the water-jar, as there was a good deal of grass and weeds to hide them. He himself did not feel any bites, but he was dressed at the time in Korean style, with trousers tight at the ankles, so the fleas would have had difficulty in getting up.

(Z) The colour of the fleas was dark brown. The water-source described in the Report was a spring-fed pool rather than a true well.

(P) Normally they are not accustomed to many fleas in that village.

(A) Nothing which might have been a container in which the fleas were dropped could be found, but they did not look very extensively.

2) Pak Yun-Ok

(O) Occasionally they saw rats and mice around the houses, but never dead ones.

[The Commission expressed its deep sympathy with this witness on her personal bereavement.]

3) Choi Ryong-So

(A) The population of the village was 936.

Scientific Experts

Dr. Choi Hyun-Soo (Chief of the Mobile Epidemic Prevention Corps) confirmed his statements in the Report.

(Z) The lymphatic system was affected in the classical way for bubonic plague.

(M) As to whether the patient was bitten by the fleas, he supposed, with the members of the Commission, that this must have occurred, but wondered also whether a sufficient inoculum of the bacilli might not have been obtained by the patient having simply washed in the water in which the fleas had floated.

Dr. Ri Yu-Kyu (bacteriologist) confirmed his statements in the Report.

Dr. Ch'en Wên-Kuei (President, Southwest Branch of Chinese Medical Association; at present seconded to the Ministry of Health and Epidemic Prevention Service of Korea)

stated that he had checked the bacteriological findings of the Korean and Chinese scientists and had satisfied himself that they were correct. The whole picture in the case of this peasant-farmer was identical not only with that of those areas where the Japanese disseminated fleas infected with *Pasteurella pestis* between 1940 and 1944, but also with that of several other places in the northern part of Korea in 1952 where plague fleas suddenly appeared in large numbers after the passage of American planes (see App. K and L). The phenomena of 1952 were, in his opinion, on a considerably larger scale than anything which the Japanese had ever attempted.

He emphasised that the fleas here identified were the human species, *Pulex irritans,* and not rat fleas or other fleas. When he had himself established at the time of the Changteh attacks that the Japanese were disseminating plague-infected fleas mixed with rice husks and cotton-wool, his Chinese colleagues found great difficulty in believing it.

Members of the Commission intervened at this point:

Dr. Pessoa said that he had himself had an opportunity of examining the material at Shenyang (Mukden) and that he entirely concurred with the opinion of Dr. Ch'en.

Dr. Needham said that the Commission had already been prepared to admit *P. irritans* as a vector, since strong evidence for this had already been brought forward as early as 1929, in the course of the well-known work of Wu Lien-Teh and his colleagues on the Tungliao outbreak of 1923 (cf. Wu Lien-Teh et al. "Studies upon the Plague Situation in North China", Nat. Med. Journ. China 1929, 15: 273, 307, 341 & 371).

Dr. Zhukov said that during the course of the Khabarovsk trial, it had been made clear by Kawashima and Karasawa, two of the defendants, that *P. irritans* had indeed been used.

Dr. Ch'en continued that towards the end of the second world war he had proposed to the Kuomintang government that they should openly declare that the Japanese had used bacteriological warfare, but they refused to follow his suggestion, and he had reason to think that it was American influence which had held the government back.

The Japanese system was to send planes to drop the fleas early morning, and then to keep up a desultory air bombardment all day for the purpose of confining the population to the shelters. When they returned to their homes in the evening, the concentrations of fleas would have dispersed and nothing untoward would be noticeable.

Dr. Ch'en remembered that at Ningpo in 1940 there was a certain amateur of goldfish who, on returning home after a daylong alert, found on the water surface of his tanks many fleas floating. Specimens of the fleas had been collected, but were unaccountably lost during the journey to Chungking. The goldfish tank episode was of interest now as a parallel to the Korean case under discussion.

(M) As to the question whether infected fleas could be sprayed directly from a plane, it was difficult to be sure. When the fleas were mixed with rice husks, the containers used might have been earthenware. When they were anaesthetised in cotton-wool, no container at all need be used. At Ningpo they may well have been directly sprayed.

In later conversation during the visit of the Commission to the laboratories of the Korean Epidemic Prevention Service near Pyongyang, where demonstrations of the plague bacilli and the techniques and facilities used for their study were arranged, Dr. Ch'en pointed out that the strains isolated from the Kang-Sou fleas and the tissues of the patient were virulent. No more than 10-20 microorganisms, (calculated by dilutions) was sufficient to kill a guinea-pig infallibly in 5 days. Human cases, like that of the present victim, succumbed rapidly, sometimes within 24 hrs. without buboes.

APPENDIX T

Report on the Spreading of Human Fleas Infected with Plague Bacilli by the U.S. Military Planes

(ISCK/3)

On April 23rd, 1952 around 10 a.m., on a hillside near Song-dong, Hoi-yang *Goon*, thousands of human fleas were found on bare ground. They were spread over an area of approximately 30 x 10 meters with a dense center of about 3-4 square meters where the ground even appeared blackish due to the vast number of fleas. This site is about 100 meters from the nearest house. Soldiers often came to this place. Witnesses Tsao and Fang were sure that no fleas were present there the day before. However, an American plane has circled low over this region for about ten minutes around 4 o'clock in the morning of April 23, without strafing or bombing. Assistant Professor Pao Ting-ch'eng investigated the very spot and the nearby regions. The conclusion was that these fleas could only have been disseminated by the American plane. The fleas (Specimen No. 1559) were identified as *Pulex irritans*. Bacteriological examination revealed *Pasteurella pestis*.

Herewith attached:

I. Report of Local Epidemic Prevention Committee (No. BC-11)

II. Reports of Eye-witnesses

III. Report of entomological identification by Professor Ho Ch'i, entomologist

IV. Report of bacteriological examination by Professor Chen Wên-kuei

V. Report of field investigation by Assistant Professor Pao Ting-Ch'eng

IV. Field map (Fig. 2).

National Emergency
Epidemic Prevention Committee
Democratic People's
Republic of Korea

June 11, 1952

DOCUMENT T-1

REPORT OF LOCAL EPIDEMIC PREVENTION COMMITTEE (No. BC-11)

1. Date of *Receiving Notification*: 5 p.m., April 23, 1952.
2. *Name of Reporting Unit*: Certain Regiment.
3. *Date of Occurrence*: Discovered at about 10 a.m., April 23, 1952.
4. *Location of Occurrence*: Hillside of Jang-ja-san Mountain near Song-dong, Ran-Kok Myon, Hoi-yang *Goon.*
5. *Condition of Weather*: Clear with breeze. Mean temperature 10°C.
6. *Name of Unit Stationed There*: Certain Unit.
7. *Kinds of Insects dropped and other Conditions*: Thousands of fleas scattered over an area of 30 x 10 meters on bare ground. At the densest spot, the ground was fully covered with fleas, appearing quite blackish. There are some small trees on the hill but the site where the fleas were found is bare; it was formerly ploughed land.
8. *Investigation*: The fleas were discovered at about 10 a.m., April 23, 1952 by Lt. Tsao Ching-Fu and Fang Yuan while resting on a nearby tree-trunk. They reported immediately to medical officer Chang Ming-Ch'u and came back together. Chang verified their findings. They discovered one dense area of about 3-4 square meters, where the number of fleas was so numerous that the ground appeared black. Specimens were collected. The fleas on the ground were burned after pouring gasoline on them. This site is about 100 meters from a road or from the nearest cottage. Soldiers visited this place quite often but none had seen the fleas before. Comrades Tsao and Fang had stayed about an hour there the day before and had definitely seen no fleas. There was no lairs or holes of animals nearby. No dogs nor cats were seen in the vicinity. An American plane had circled over this place about 4 o'clock in the morning. Assistant Professor Pao Ting-Ch'eng made an on-the-spot investigation and concluded that there could be no other possibility than that American plane had disseminated these fleas.
9. *Eye-witnessess* Ts'ao Ching-Fu (Surveyor), Fang Yuan (Surveyor) and Chang Ming-ch'u (Medical Officer).
10. *Specimen Collectors*: The same.

11. *Specimen:* Fleas, about forty in number, in a bottle.

12. *Measures taken:* The fleas were burned on the spot. Anti-plague propaganda and an anti-rat campaign including spraying of DDT were carried out in the unit and the villages. Dead rats were to be looked for. Persons who had been in contact with the fleas were isolated for nine days and prophylactic doses of sulfa-drugs were given.

13. *Conclusion:* The fleas were clearly spread by the American plane. Reasons: (1) There were no fleas the previous day at the place. (2) There were no sign of animal lairs or holes at the place. (3) The number of fleas was far too numerous to be a natural phenomenon (4) An American plane had circled over the place on the same morning.

Hsu Hsiao-P'ong (*Signed*)

Head of Medical Department of Certain Unit

April 30, 1952.

DOCUMENT T-2

REPORTS OF EYE-WITNESSES

Tsao Ching-fu and Fang Yuan

I am Ts'ao Ching-Fu, 21 years old, Lieutenant of Topographic Unit of a Certain Regiment. I am willing to take full responsibility for the reliability of the following facts I witnessed.

On April 23, 1952, after breakfast, Fang Yuan and I went to a valley on Jang-ja-san Mountain to bring back trees that had been cut down the day before to build our shelters. After two trips were completed, we came to the place where we had worked in the late afternoon of the previous day. While resting on a tree trunk (around 10 o'clock in the morning), I noticed two tiny blackish insects screeping on my right shoe. On close examination I saw that they were fleas. There were also four or five fleas on the lower part of my trousers. We were very much surprised. Where could these fleas come from? We had not noticed any fleas in this place when we were there the day before. We left this place and on a rock I stripped off all my clothes to get free of the fleas. We immediately reported this to medical officer Chang Ming-Ch'u. Then we all went back together to investigate. I walked in front and started from the spot where I discovered the fleas first. Though fleas were jumping on to my trousers as I went forward they were not so many. After a distance of 20 meters I saw an area almost black in color. As I stepped

towards it, numerous fleas jumped on to my trousers. I retreated immediately and we caught some forty fleas from my trousers for specimens. Then we inspected again that dense area and estimated it occupied 3-4 square meters. We went back and brought with us two more persons and three barrels of gasoline. Mixing pine-tree branches with the gasoline, we set fire to the fleas. The total flea contaminated area was about 30 x 10 meters. An American plane had been circling over this region for about 10 minutes around 4 o'clock that morning. The noise of the plane was quite loud.

Witness: Lt. Ts'ao Ching-Fu (*Signed*)

April 25, 1952

What has been reported by Lt. Ts'ao Ching-Fu is fully in accordance with the facts I witnessed. I fully agree with him.

Witness: Lt. Fang Yuan (*Signed*)

April 25, 1952

Report of Medical Officer Chang Ming-Ch'u

A. On April 23, 1952, some time after 10 a.m., Lt. Ts'ao Ching-Fu and Lt. Fang Yuan reported that they had discovered some fleas on bare ground near where they cut wood. I took an empty bottle and some alcohol in another bottle and immediately accompanied them back to the spot to make further investigations.

B. The fleas were found on a formerly ploughed field in a valley of Jang-ja-san near Song-dong. Nearby was a small brook. There was no tree in that field and only small trees on the slopes of the hill. (A map of the place drawn by Lt. Ts'ao Ching-Fu is shown in Fig. 2.) Ts'ao found a dense area of fleas. The moment he stepped on the spot, numerous fleas jumped and crept on to his trousers. He got out of the spot immediately and on his trousers we collected some forty fleas and put them into the bottle for specimens. We found that this dense area occupied about 3-4 square meters. The total area contaminated with fleas was about 30 meters in length and 10 meters in width. We went back to our headquarters and returned with three barrels of gasoline. The regimental barber Hsü and a messenger from the Regimental Headquarters came along with us. The fleas were burned with gasoline on the spot.

C. Concerning the eradication of the fleas: The spot was burnt from the periphery towards the center with gasoline and pine tree branches. We wore masks and had tightened the openings of our sleeves

and trousers. We used alcohol to sponge our hands afterwards. When we returned to our quarters, we took baths and changed our clothes. The dirty clothes were soaked in boiling water and our quarters sprayed with DDT. We five also took sulfathiazole for prophylaxis, two tablets each time, three times a day for three successive days. We were ordered to be quarantined for 9 days. A mass health movement was started. All dugouts in the vicinity were sprayed with DDT.

D. The weather was cold. The valley was covered in some places with snow, and Tsao Ching-Fu was wearing a cotton padded uniform the day before.

E. Investigation of surroundings:

(a) The place where the fleas were found is about 100 meters from the nearest road and more than 100 meters from the nearest houses.

(b) This place was often frequented by soldiers. Tsao and Fang had been there one day prior to the discovery of the fleas, yet they saw no flea there.

(c) No foxes, wolves or deer were seen on the mountain or its vicinity. The nearest residential district of the villagers keep few small dogs.

(d) An American plane was circling low over this place at about 4 a.m. that day (April 23, 1952).

F. We conclude that these fleas were disseminated by the American plane. I have submitted the flea specimen to superior authorities for examination and suggested anti-rat-and-flea campaigns and preventive inoculation to be carried out in our unit.

Chang Ming-Ch'u (Signed)
Medical Officer of Certain Unit

April 25, 1952

DOCUMENT T-3

REPORT ON ENTOMOLOGICAL IDENTIFICATION

Name of Specimen: Flea Date of Collection: April 23, 1952.
Specimen No.: 1559 Date received: May 3, 1952.
Collector: Tsao Ching-fu, Fang Yuan and Chang Ming-Ch'u
Location of Collection: Jang-ja-san, Song Dong, Hoi-yang *Goon.*

Condition of Specimen: In an empty penicillin bottle.
Identifications: No. 1559 Human flea *Pulex irritans* (Fig. 1)
Family: Pulicidae,
Order: Siphonaptera

Professor Ho Ch'i, (Signed)
Entomologist

Date of report: May 4th, 1952.

DOCUMENT T-4

REPORT ON BACTERIOLOGICAL EXAMINATION

Specimen Examined: 31 fleas Date of Collection: April 23, 1952
Specimen No.: 1559-359 Date of Examination: May 3, 1952
Collector: Tsao Ching-Fu, Fang Yuan and Chang Ming-Ch'u
Location of Collection: Jang-ja-san, Song Dong, Hoi-yang *Goon*.
Condition of specimen: In the empty penicillin bottle.

Procedures of Examination

The 31 fleas were washed in sterile saline three times. Then they were ground in a sterile mortar with 2 c.c. sterile saline.

I. Smear examination:

Direct smear was made and stained by methylene blue and Gram's method. Besides a few Gram-positive cocci and Gram-negative bacilli were present, no bipolar stained bacilli were found.

II. Culture method:

One loopful of the above emulsion was streaked on a blood agar plate. After 48 hrs' incubation at 30°-32°C, many colonies of *staphylococcus albus* and coliform bacteria were found. No pathogenic organism was present.

III. Animal inoculation:

About one c.c. of the fleas emulsion was injected intraperitoneally into guinea pig No. 22. The animal died on the 9th day of the inoculation.

Autopsy findings: Subcutaneous congestion with enlarged, and congested inguinal lymph nodes on both sides were found. After the abdomen was cut open, general peritonitis with inflammatory exudate was seen to be present. The mesentery lymph nodes were enlarged and congested. The spleen was markedly enlarged and congested, showing numerous whitish miliary necrosis. Liver and lungs were congested.

Stained smears of the internal organs all revealed Gram-negative bipolar stained bacilli, oval in shape. Most numerous bacilli were seen in the smears of spleen and lymph nodes.

The heart blood, and the cut surfaces of lung, liver, spleen and lymph nodes were smeared separately over portions of a blood agar plate. From the heart blood and the spleen pure strains were isolated.

(A) Cultural characteristics,—meat infusion broth tubes inoculated with a single colony, when incubated at 30°-32°C for 48 hrs, showed no turbidity, the broth remained clear with floccular and granular growth at the bottom of the tube. When cultivated on nutrient agar for 48 hrs, at 30°-32°C, the colonies were less than 1 mm. in diameter, grayish white under reflected light, and bluish gray and translucent by transmitted light. Examined under the microscope at a magnification of 100 X, the colonies appeared to have a dark granular surface. The central part of the colonies was raised and the periphery irregular and thinned out. These complied with the typical appearance of colonies of plague bacilli.

(B) The pure culture showed the following biochemical reactions:

1. Glucose, maltose and mannitol showed acid reaction with no gas formation.
2. Lactose, saccharose rhamnose, and sorbitol remained unchanged.
3. Indol and H_2S were not produced.
4. The organism was non-motile.
5. No growth on Bessonova acid agar.

(C) Serological reactions:

1. Heat precipitation test was positive.
2. Agglutination test was positive with the first reading of 1:160 and the end titre of 1:320.

(D) Bacteriophage susceptibility test: Positive both on agar plate culture and in broth tube culture.

(E) Animal skin test: One loopful of pure culture of 24 hrs' agar slant growth was smeared over the shaven skin of the right lower abdomen of guinea pig No. 23. At the 6th day of inoculation the animal died.

Autopsy findings: Local hemorrhagic necrosis with subcutaneous edema and inflammation of the surrounding tissue were present over the shaven region. Inguinal lymph nodes of both sides were swollen and congested. That of the right side was markedly enlarged, with the cut surface showing hemorrhagic necrosis. Liver and lungs were congested. Spleen was markedly enlarged showing miliary necrosis over the whole organ.

1. Smears made from the heart blood, lung, liver, spleen and lymph nodes, and stained with methylene blue and Gram's method all revealed Gram-negative, bipolar stained bacilli.

2. The pure bacterial strains isolated from the heart blood and spleen of the guinea pig No. 23 showed the same cultural and biochemical characteristics as described above for the pure culture used in this animal test.

3. Serological reactions:

a. Heat precipitation test was positive.

b. Agglutination test was positive with the first reading of 1:160 and the end titre of 1:320.

4. Bacteriophage susceptibility test: Positive both on agar plate culture and in broth tube culture.

CONCLUSION

Pasteurella pestis found in the specimen examined.

Chen Wên-kwei, M. D. (Signed)
Professor of Bacteriology

Date of report: May 28, 1952

DOCUMENT T-5

REPORT OF FIELD INVESTIGATION ON THE DISCOVERY OF FLEAS AT SONG-DONG, HOI-YANG GOON

On April 26, 1952 the Epidemic Prevention Technical Unit (EPTU) stationed at Headquarters received the flea specimen and a report from certain regiment that on April 23rd an American plane had spread a large number of fleas at Jang-ja-san near the district where certain unit was billeted. I was immediately sent to the spot to conduct a field investigation, the results of which are summarised as followed:

1. *Date of Investigation*: Started and arrived on April 26, 1952, after two days of investigation, returned on April the 28th.

2. *Eye-witness Accounts*: The persons who first discovered the fleas were Lts. Tsao Ching-Fu and Fang Yuan. According to their report, they were at the spot cutting woods for building dug out shelters on April the 22nd and had not noticed anything abnormal. On April the 23rd, at about ten in the morning, they went there again to carry back the wood that had been cut down the day before. As they were sitting down there for a chat, Tsao Ching-Fu, noticed that there were two tiny blackish insects on his right boot, which turned out to be fleas on close examination. On his trousers he discovered several more. They reported this incident

to their medical officer Chang Ming-Ch'u who returned together with them to make further investigations. They discovered a very large number of fleas at the spot. They collected 30 to 40 fleas and put them in a small bottle for specimens. The area of dissemination, according to their estimate, was about 30 meters in length and about 10 meters in maximum width. The thickest spot was about 3 to 4 square meters. The fleas were burnt with gasoline and pine branches on the spot.

3. *Condition of the Place where the Fleas were Discovered*: The location of the dissemination area of these fleas was a relatively level ground in a valley near Jang-ja-san at Song-dong, Hoi-yang Goon. This relatively level ground is about one hundred and several tens of meters in length and about 20 meters in width. It was once a ploughed field. There are no trees and very little grass in the area. Along one side of the field there is a little stream. When I arrived at the spot, the fleas had already been burnt. The charred ground occupied an area of about 30 meters in length and 10 meters in width. The snow still remained unmelted in some shaddy places, but there was no snow on the spot because it faces the sun. The nearest road is about 100 meters from the spot, and there are no civilian building nearby. It is about 100 meters from the district where certain unit billeted.

4. *Activities of American Planes*: This place is quite near the front and American planes, therefore, often fly over it. On April the 23rd, at about 4 a.m. an American plane circled low over this place for quite a while without strafing or bombing.

5. *Measures Taken.* The fleas were burnt on the spot. All persons who had participated in the flea eradication operation were quarantined and given sulfathiazole for prophylaxis. The quarters were sprayed with DDT. The health workers of the Unit were instructed to be on the alert for possible outbreaks of plague cases. The anti-rat-and-flea campaign was strengthened and boost-inoculations against plague given.

6. *Entomological identification* done by our Laboratory at the Headquarters revealed that the 37 fleas collected at the spot were all *Pulex irritans*. After the preliminary entomological identification, these fleas were sent to the Headquarters, EPTUCPVF for bacteriological examination.

7. *Discussion*: According to the reports of Lts. Tsao Ching-Fu and Fang Yuan they noticed that a large number of fleas made a sudden appearance in the morning at a place where these fleas were absent the previous afternoon. Could this have happened naturally? Fleas are ectoparasites. *Pulex irritans* commonly takes man and the dog for its hosts and often in other animals such as the fox and wolf. It is absolutely im-

possible for such a great number of human fleas to drop down on the ground from the human body or from other animals. Nor is it possible that these fleas could have hatched in the open fields from eggs which had been dropped on the ground from human and animal bodies. The reasons for this opinion are as follows:

(a) *The Number* of *Eggs Laid by Pulex irritans*: The total number of eggs laid by one female human flea during her whole life is about 100 to 500, averaging 3 to 8 eggs per day. According to Bacot's observations, one female human flea was able to lay 448 eggs within a period of 196 days, and many of them were sterile ones. It is evident that it would require a tremendous number of female fleas to lay eggs at the same time to make the sudden appearance of such a great number of fleas as was observed. It is in fact impossible under natural condition. Besides, there was no human habitation nor animal holes nor dogs at or any where near the spot where the fleas were found.

(b) *The Problem of the Nourishment and Development of the Flea Larva*: The larva feeds on organic matters. Some larvae have to feed on partially digested material excreted by adult fleas. Their breeding places are, therefore, usually inside empty houses, godowns and animals' lairs. The open ground where these fleas were found is exposed to sun and rain, and there was no animal lairs. It therefore could not have been a breeding place for fleas.

(c) *Influence of Direct Sunlight*: Under dry conditions and exposed directly to sunlight, the flea larvae and pupae are liable to be killed.

(d) *Various Lengths of Time for The Development of Larvae*: The length of time for the development of the adult flea from pupa, larva and egg varies with the condition of the external environment and the intrinsic factors of the organism. Inasmuch as not all the eggs are laid at one time by each female flea, it is impossible on scientific analysis to expect a large number of fleas to appear at the same time and on the same spot, at a place which would be detrimental to their existence.

On the basis of the above reasons and the actual conditions that I discovered in the field investigation, I must conclude without any hesitation that the fleas discovered at the above mentioned place must have been disseminated by the American plane.

Pao Ting-ch'eng
Entomologist, EPTUCPVF

April 29, 1952

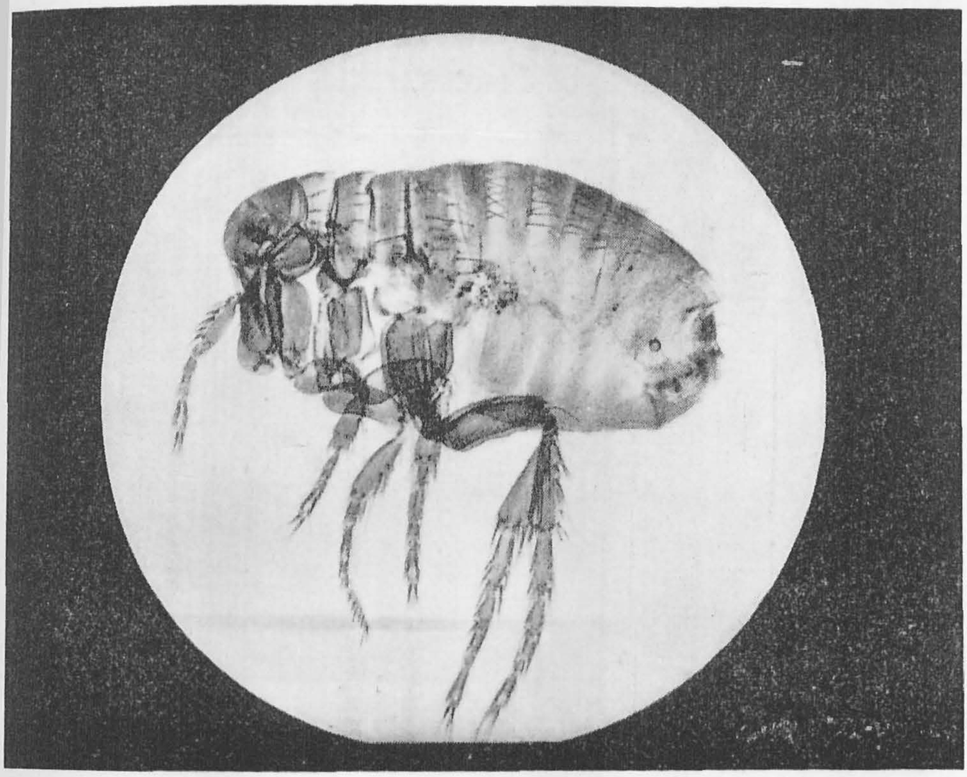


Fig. 1. *Pulex irritans* disseminated by an American plane at Song-Dong, Hoi-Yang Goon, Korea.

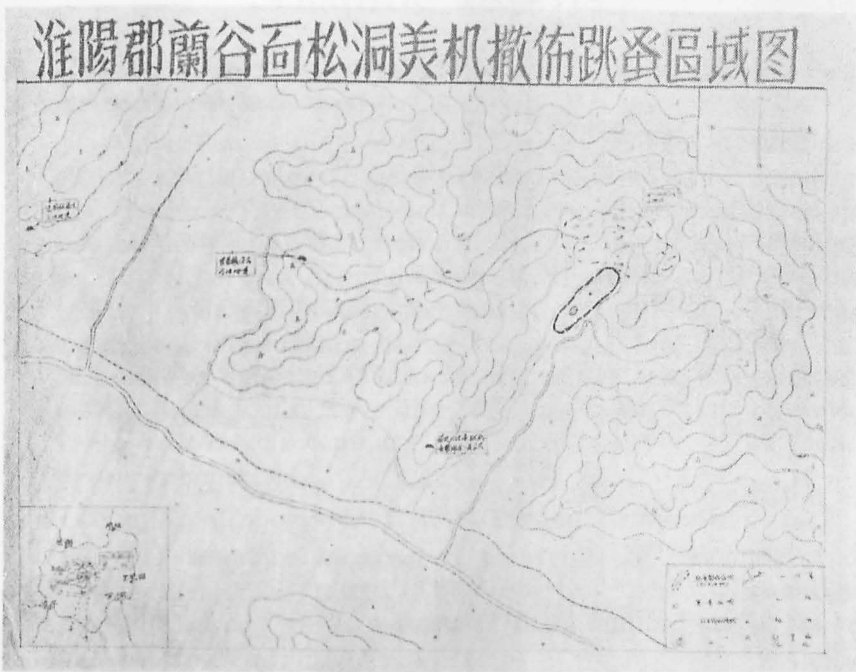


Fig. 2. Field map showing the position of the swarm of fleas disseminated by an American military plane at Song-Dong, Hoi-Yang Goon.

APPENDIX U

Hearings on the Hoi-Yang Incident (Plague): Statements of Eye-Witnesses and Scientific Experts

Dr. Woo Dji-Lee (Director-General of Medical Services, Chinese People's Volunteer Forces in Korea)

drew attention to the fact that this case had been worked out by CPVF, as the original discovery had been made by members of these forces. The Commission was invited to inspect a map showing the position of the swarm of fleas on the hillside. It formed an ellipsoidal area approximately 30 yds. long by 10 yds. broad, the long axis of the area pointing NNE and SSW. The zone of maximum concentration of the fleas was around the SSW centre, as would be expected if some container had emptied its contents mostly there while travelling NNE with some residual velocity. There was no trace of any container, however, to be found in the neighbourhood.

Lt. Ts'ao Ching-Fu (Topographical Unit, certain Regiment)

said that when he approached the centre of the mass of fleas, they darkened the ground. The densest part had, he would guess, about 10,000/sq. yd. Hundreds of them climbed on to his boots and his trousers.

(M) The failure of this batch to infect any human beings with plague might well be due to the fact that the point of impact was at least 100 yds. from the nearest road or path. All CPVF members had strict orders to wear trousers tucked inside their boots. After the discovery, they sterilised their hands with alcohol and tied up the ends of their sleeves before returning to consume the fleas by fire. Finally they changed their clothes and boiled them, took baths, and disinfected their dugouts with anti-septics and DDT.

Lt. Fang Yuan (Topographic Unit, certain Regiment)

concurred with the evidence of his companion, Lt. Ts'ao, in all particulars.

(N) Both they and all others in their unit had previously been inoculated against plague.

(P) Neither felt any bites.

Dr. Pao Ting-Ch'êng (Entomologist, Epidemic Prevention Technical Unit, CPVF).

(M) One could hardly expect to collect more than 50 fleas at one time from a very dirty house. Individual fleas do not lay many eggs at one time. The occurrence of such immense numbers of human fleas at a deserted spot on a hillside can only be regarded as highly unnatural.

(P) The temperature was only 10°C at the time, but human fleas withstand cold better than animal ones.

Dr. Ho Ch'i (Entomologist, seconded to Korean Epidemic Prevention Service)

(P) Precipitin tests to ascertain what blood might be in the fleas had not been done.

(M) As to the age of the fleas, and whether the population was all of one age, would be difficult to ascertain, for lack of suitable methods.

APPENDIX V

Report on the Calcareous Bacteriological Bomb Dropped by U.S. Military Plane at K'uan-Tien Hsien, Liaotung Province

(ISCC/3)

On March 21st, 1952, hundreds of fragments of a bomb and a cap-shaped steel plate with an iron axis were discovered at K'uantien Hsien in Liaotung Province. By means of physical method to detect the form of the bomb and by means of x-ray method, spectrographic and chemical analyses to determine the composition of these fragments, it has been proved that they are the remnants of a bacterial bomb made of calcareous material. Near these bomb fragments were anthomyiid flies, spiders and feathers. Bacteriological examinations of these anthomyiid flies, spiders and feathers proved that they carried *Bacillus anthracis*. The detailed report is given below:

With reference to March 12th, 1952, Han Yung-pin, salesman in the T'ung-chü-ho grocery situated inside the south gate of K'uan-tien city, reported: "At noon time, eight American airplanes flew from the west toward the east. With my own eyes I saw one of them drop a white object which resembled a cylinder. At the beginning it fell rather slowly, but when it approached the ground, the speed rapidly increased. It seemed to drop near the east gate." At 12:52 on the same day, the Air-Observer Corps reported that eight American airplanes flew from Ku-lou-tze in the southwest, over the district, and then away toward the northeast.

On receiving the report, Kao Chun-shan, the District Constable, immediately organized the public and pupils of the primary school, a total of six hundred and ninety one persons, to search inside the east gate until 3:50 p.m. They found no trace of any object. But at 1:30 in the afternoon of March 21st, Li Ssu-chien, first year school boy of K'uan-Tien Middle School, while searching for insects outside the east gate with his school mates, discovered many feathers in a maize field about 150 meters from Lou-ho-t'ao highway and a kilometer from the gate. Among the feathers were white and yellow downy ones and black quills, with clean and perfect shafts. No debris of bird's skeletons was discovered in the neighbourhood of these feathers. Li suspected that these

were related to bacteriological warfare. He searched towards the southeast direction, and about 8 meters away he saw a bomb crater about 12 cm. deep on the ground, elliptical in shape with its long axis northeast. Three meters northeast from the crater was a bent iron axis, connected at one end to a distorted cap-shaped steel plate. Northeast of the crater there were hundreds of silvery white bomb fragments of various sizes scattered along a narrow zone. Flies and spiders were also found nearby. This discovery was immediately reported to the magistrate and the bomb fragments were collected and sent to the government. The magistrate, Hu An, went to the spot to investigate into the matter, and he was able to verify all the facts..

I. *Examination by Physical Methods*

Material: (a) The iron axis and the distorted cap-shaped steel plate.

(b) Two hundred and three fragments of various sizes.

1. Deduction of the form of the bomb.

(1) Seventeen comparatively regularly shaped fragments, the curvatures of which were still measurable, were selected and put together into fourteen pieces (among which the largest piece was 10 $cm.^2$ and the smallest 2 $cm.^2$). The radii of curvature as measured from various directions of their inner curvatures proved that the bomb was not spherical in shape, but was a cylinder with a round end and a radius of 14 ± 1 cm. The data were not adequate to make a reasonable deduction of the shape of the other end.

(2) The head of the bomb was semispherical and seemed to be made of steel. Its radius of curvature measured 12.5 cm., and it was connected at the center with a cylindrical iron axis, 28 cm. in length and 6 mm. in diameter. Both ends of the axis were each fixed with a screw. One of the screws was soldered with tin to the outer surface of the plate, but at the time of discovery of the remnants of the bomb the soldering was broken. The diameter of the circular rim of the metal plate measured 17.4 cm. and there was evidence of soldering along this rim.

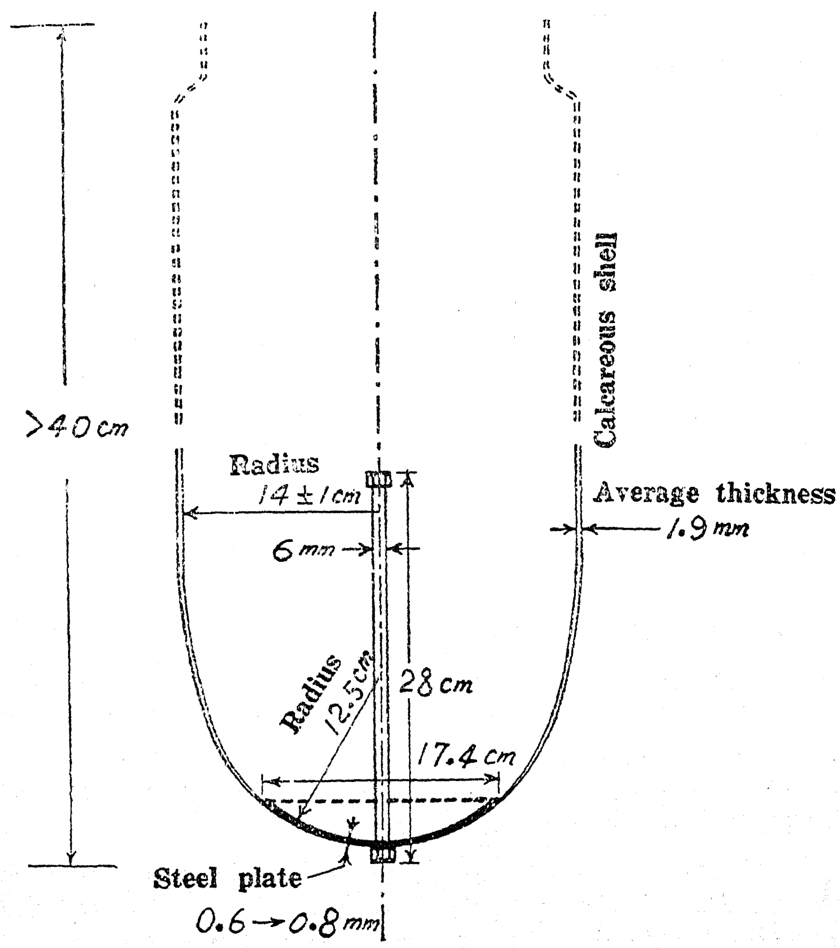
(3) The head of the bomb measured 0.6-0.8 mm. in thickness and was metallic gray in color.

(4) The fragments, the outer convex surface of which was silvery white in color, as coated with aluminum paint, seemed to consist of calcareous material, light grayish yellow in color. The inner concave surface was polished but showed minute pores. It seemed that the calcareous material had been pasted on a smooth surface. At the middle of the cylindrical part of the bomb, the calcareous shell measured 1.9 mm. in thickness in average.

(5) There were still traces of aluminum painted calcareous material on the outer surface of the head of the bomb. The thickness of the calcareous material gradually thinned out toward the vertex of the bomb.

(6) A number of fragments were 3.6 mm. thick, and according to their appearance these fragments seemed to be those of the rim of the vessel. There were several pieces the curvature of which revealed a more complex situation. Besides, there were other fragments having grooves on their inner curvature surfaces. It seemed that the calcareous material was supported by wide strips of a mould in its manufacturing processes.

Basing on the above-mentioned observations and measurements, we think the following figure may represent a part of the bomb:



However, it is to be noticed:

(1) The rim of the metal plate showed evidence of soldering, but the part of the bomb which was soldered to it was not found.

(2) The calcareous material was very brittle. Suppose the bomb was 40 cm. long, the calcareous vessel itself would weigh up to two kilograms. In addition, the contents of the vessel would mean more weight. It seemed to be very difficult for such brittle calcareous material to hold all the weight together.

The study on the deduction of the form of the bomb was conducted by Chao Chung-yao and Ho Zah-wei, research members of the Institute of Modern Physics, Academia Sinica, and Yeh Ming-han, research assistant of the same institute. (Document V-1a).

2. Examination by X-ray method.

After being scraped off the aluminium paint, the fragments of calcareous material were ground to fine powder. This powder was stuck with Canadian balsam onto a single glass wool fibre which was put into a self-made X-ray camera, 9 cm. in diameter, for photography of powder. The X-rays applied was Cukα, the high voltage was 50 KV; and the electron emission was 12 ma.

The photographic films were developed, and the distances between the spectral lines measured by a comparator. The relative intensities of the principal lines were determined by a microphotometer. The comparison of the data with Card No. 1-0837 of the X-rays Diffraction Data Cards of A.S.T.M. (American Society of Testing Materials) proved that the sample under investigation consists chiefly *calcite*, the chemical composition being calcium carbonate ($CaCO_3$).

This study was performed by Woo Chien-chang, assistant research member of the Institute of Applied Physics, Academia Sinica. (Document V-1b).

3. Spectrographic analysis.

The equipment used for analysis was the large size quartz spectroscope (Adam Hilger E1). The wave lengths used ranged between 2600-4200 Å. The exciting source was a D. C. arc, and the electrodes consisted of graphite rods of 5 mm. in diameter and 8 cm. in length. The spectrum for comparison was that of pure iron.

(1) The head of the bomb: The spectrographic analysis indicated that the material consisted principally of iron (Fe) with a small quantity of zinc (Zn), manganese (Mn) and copper (Cu) and a trace of tin (Sn). The head of the bomb was therefore proved to be made of steel.

(2) The solder on the rim of the head of the bomb: The spectrographic analysis indicated its main constituents to be tin and lead and proved accordingly this was an ordinary solder.

(3) The calcareous bomb fragments: (a) The spectrum taken from the powders made by grinding a whole piece of the bomb fragment indicated that the principal constituents were calcium, magnesium and aluminium, with a small quantity of tin. (b) The metallic paint on the outer surface was scraped off, and the following three portions were taken for analysis:

(i) a layer of 0.2 mm. taken from its inner concave surface;
(ii) a layer of 0.3 mm. taken from the groove on its inner surface;
(iii) a layer of 0.2 mm. taken from the outer surface after the metallic layer was stripped off.

The results of analysis of these portions indicated that the compositions of the material of the three layers were identical, being mainly calcium and magnesium with small quantity of tin.

It was therefore proved that the outer metallic layer of the calcareous fragments was aluminum paint, and that the composition of the calcareous material itself was identical throughout the whole thickness, consisting mainly of calcium and magnesium.

The spectrographic analysis was performed by Chang Chih-san assistant research member of the Institute of Applied Physics, Academia Sinica. (Document V-1c).

II. *Examination by Chemical Methods*

A sample of the calcareous material was heated to 500°C, to remove water and organic substances contained. The layer of aluminum paint dropped off. The sample was weighed again. The result of quantitative analysis was as follows:

1. Amorphous calcium carbonate ($CaCO_3$) 86.18%
2. Weight lost on ignition (at about 500°C) 10.58%
3. Aluminum paint 1.52%
4. Other substances 1.72%

Silicon dioxide (SiO_2)
Ferric oxide (Fe_2O_3)
Aluminum oxide (Al_2O_3)
Magnesium oxide (MgO)

Based on this result of chemical analysis, conclusion can be drawn that the above-mentioned bomb fragments are chiefly composed of calcium carbonate, mixed with gelatin. The outside silvery white thin layer is aluminum paint.

The above chemical anlysis was done by Chang Yu-chang director of Chemical Laboratory, Institute of Science, Ministry of Industries, People's Government of Northeast China and Yuan Hsiu-shun technician in the same laboratory. (Document V-2).

III. *Discussion on the Results of Examinations by Physical and Chemical Methods*

From the results of examinations by physical and chemical methods, we derive the following conclusion:

The cap-shaped steel plate, iron axis and two hundred and three pieces of bomb fragments found near the bomb crater at K'uantien are the remnants of a calcareous shell bomb. From the facts of distortion of steel plate and iron axis and of the depth of the bomb crater, we can deduce that the bomb hit the ground at high speed. After hitting the ground, it burst either automatically or mechanically into several hundred pieces. In view of the presence of the iron axis, we incline to believe that a bursting mechanism was present inside the bomb. However, those who collected the fragments at the spot paid no particular attention to looking for any such material.

The head portion of the bomb was probably shaped like a round dome, while the shape of the tail cannot be ascertained because of lack of data. The whole length of the bomb seems to be longer than 40 cm. The coating of a layer of aluminum paint on the surface of the calcareous substance is for the purposes, on the one hand, of reducing the chance of being easily noticed, and on the other hand for reflecting the sunshine so as to avoid the elevation of temperature inside the bomb.

The calcareous material is light and brittle. Magnesium compounds have the property of insulating heat. These materials when mixed with gelatin, may become a plastic substance. According to the size of the calcareous vase as shaped, it is very difficult for the thin layer of the calcareous material to sustain the whole weight of the vase itself and that of its contents. This fact together with the presence of minute pores on the inner polished surface of the calcareous fragments and of grooves on a number of them and the finding of evidence of soldering on the rim of the cap-shaped steel plate, makes one suspect that inside the calcareous layer there was a very brittle metallic frame or thin foil. However those who collected the fragments at the spot paid no particular attention to looking for any of such material.

IV. *Entomological Identifications*

Flies and spiders were collected by the inhabitants nearby Lou-ho-t'ao outside the east gate of K'uan-tien and by the entomologist of Academia Sinica, Dr. Ma Shih-chun and others in the neighbourhood of the bomb crater and vicinities of Lou-ho-t'ao. These flies have been identified by entomologists Dr. Chen Sicien H. and Professor Lu Pao-lin as *Hylemyia* sp. and the spiders identified by Professor Wang Feng-chen (Specialist in Arachnida) as Tarentula sp. (Documents V-3 & V-4).

V. *Bacteriological Examinations*

The anthomyiid flies, wolf spiders and feathers collected were subjected to bacteriological examinations. The results are as follows:

The flies, spiders and feathers were washed in sterile normal saline separately. Each of the washing solutions was inoculated into various media and white mice. At the same time, the flies, spiders were ground up separately and the suspensions were inoculated into various media. After 24 hours incubation, both plain and blood agar plates showed grayish white colonies. Each colony had a rough surface and irregular edge. But there was no hemolysis. The examination of stained smear revealed chain-like Gram positive bacilli with square ends. The inoculated white mice dided in about 24 hours. Examinations and culturing of the spleen, liver, lungs and heart blood revealed the same kind of bacilli. No motility was observed. It was transferred into various sugar tubes and special media. The following characteristics were noticed:

1. Bouillon: growth with flocculent sediments
2. Milk: coagulated
3. Fermentation reactions:
   It fermented glucose, maltose and sucrose with production of acid but no gas.
   It did not ferment lactose, mannitol. dulcitol, inositol, xylose, arabinose or salicin.
4. No production of indol and hydrogen sulfide.
5. Hemolytic test: negative

A 24 hours' pure culture was used to make a suspension, and injected subcutaneously into a guinea pig. The guinea pig died in 2-3 days. On autopsy, the spleen was found to be enlarged and at the site of injection, there was gelatinous degeneration. Examination of stained smears made from the heart blood and local exudate revealed in both the presence of Gram-positive encapsulated bacilli. The culture of the heart blood grew with the same kind of bacteria as before. At the same time, the bacteria

suspension made from pure culture was injected into white mice. The mice were dead in 1-2 days. Direct smears revealed Gram positive bacilli with capsule formation. And on culturing, same results were obtained. Ascoli test: Positive.

Based on these results it is proved that the anthomyiid flies, wolf spiders and feathers all carried *Bacillus anthracis*.

The above bacteriological examinations of flies and wolf spiders were done by Dr. Hsin Chün and those of the feathers were done by Dr. Hsieh Shao-wen (Samuel Zia), Dr. Chang Nai-ch'u and Wang Chin-tung. (Documents V-5, V-6 & V-7).

Discussion

(1) The distorted iron axis and cap-shaped steel plate, and the calcareous fragments discovered near Lou-ho-t'ao highway outside the east gate of K'uan-tien City were neither farmer's implements nor household utensils. It is difficult to explain the fact that they were discovered in a maize field. Hence these things must have come from elsewhere. From the distortion of the iron axis and cap-shaped steel plate, the shape and direction of the crater and the distribution of the fragments, all of these phenomena can only be explained by the impact of the bomb falling rapidly from a height. Therefore, we conclude that these things must have been dropped from the air.

(2) On March 12th, at noon, there was an air intrusion in K'uan-tien by American airplanes as reported by the Air-Observer Corps. At the same time, the grocer salesman Han Yung-pin living inside the south gate of the city saw an Amercian airplane drop a white object, which fell slowly at first but accelerated on approaching the ground. It looked like a long cylinder and seemed to drop inside the east gate. Although the district administration mobilized a number of persons to search for it, this was not discovered until on March 21st, a student of K'uan-tien Middle School named Li Ssu-chien discovered in a maize field one kilometer outside the east gate, a bomb crater, hundreds of aluminum coated calcareous fragments, distorted cap-shaped steel plate and an iron axis. On the basis of the above reports and judging from the time, location, shape and the color of the bomb, we can only conclude that the calcareous fragments, steel plate and iron axis found by Li Ssu-chien were the remnants of the white cylindrical object dropped from the American airplane as seen by Han Yung-pin.

(3) The bomb is made of calcite which breaks easily. The addition of magnesium compounds (such as magnesium oxide, etc.) to the calcite gives heat insulation to the bomb and the coating of the surface of the

calcite with aluminum paint also prevents the increase of temperature of the bomb by reflecting the sun light. The purpose of using these things is evidently to make the interior temperature of the vessel as independent as possible of the outside temperature and sun light, in order to fit the living conditions of bacteria and insects inside the bomb and to let the contents of the bomb disperse easily on bursting. Therefore it is evident that this kind of bomb is made after an elaborate and careful design, for the use in bacteriological warfare.

(4) In the neighbourhood of the bomb crater, we discovered feathers, spiders and flies, as well as the bomb fragments. According to their ecology, it was impossible under natural conditions for these insects and spiders to appear in large numbers at such places and in such a season. It is, therefore, affirmed that the appearance of these insects and spiders was unusual and that they were evidently disseminated from the bacterial bomb. From these anthomyiid flies, wolf spiders and feathers, *Bacillus anthracis* has been isolated. Their morphology, cultural characteristics and biochemical reactions were all identical. This is even more unusual. According to the study by Dr. Chang Nai-chu who examined various specimens of feathers collected from inside and outside of Peking City for anthrax bacillus and according to Dr. Hsin Chun who did similar work on feathers collected at Shenyang and K'uan-tien, definitely known as being not dropped from the air, it has been proved that the local specimens of feathers do not carry *Bacillus anthracis*. Therefore, the above-mentioned fact that *Bacillus anthracis* has been isolated from the feathers, anthomyiid flies and wolf spiders collected from the neighbourhood of the bomb crater at Lou-ho-t'ao, K'uan-tien, proves affirmatively that the American airplanes were carrying out bacteriological warfare by dropping the calcareous bacterial bomb which contained feathers, anthomyiid flies and wolf spiders laden with *Bacillus anthracis*.

On the basis of the above evidence and reasoning, we affirm that an American airplane dropped a calcareous bacterial bomb at K'uan-tien in order to spread *Bacillus anthracis*.

DOCUMENT V-1a

STUDY ON THE EXTERNAL SHAPE OF THE CALCAREOUS BACTERIAL BOMB

Material:

(1) The iron axis and the distorted iron cap,

(2) Two hundred and three fragments of calcareous material of various sizes.

Method of Measurement:

(1) Measurement of the iron axis and the iron cap: The size and shape of the iron axis and iron cap are determined by a scale and a vernier caliper. The thickness of the iron plate is measured by a micrometer gauge. The weight of the iron plate is measured by a balance.

(2) Measurement of the calcareous fragments: The main object is to determine the radii of curvature of these fragments and to deduce thereby the external shape of the shell. Two methods are adopted: (a) to determine the radius of curvature by means of a reading microscope, (b) to determine the radius of curvature by means of a curvature measuring instrument used by opticians. Comparatively intact fragments are selected. Several of them can be put together into larger pieces. For each selected piece, the radii of curvature of the inner surface along various directions are determined by the two methods mentioned above, the maximum and minimum radii of curvature are determined for each piece. The thickness of the selected pieces is determined by a micrometer gauge.

Result & Discussion:

(1) The radius of curvature of the distorted iron cap is found to be 12.5 cm., the diameter of the circular rim is 17.4 cm., and the thickness of the cap varies from 0.6-0.8 mm. From the volume of the cap and its weight we determine the approximate density of the material of the cap. The density thus deduced is in good agreement with the density of iron. The iron cap is connected at the center with the iron axis which is 28 cm. in length and 6 mm. in diameter. Each end of the axis is fixed by a screw. One screw was soldered with tin to the outer surface of the plate. But when the remnants of the bomb were discovered, the soldering was broken. There was evidence of soldering along the rim of the cap.

(2) Seventeen comparatively intact fragments are selected. They can be put together into fourteen pieces. Among these, the largest piece has an area about 10 $cm.^2$ and the smallest about 2 $cm.^2$

The radii of curvature as determined by the reading microscope and by the curvature measuring instrument are in good agreement. The result of curvature determination proves that the bomb was not spherical in shape, but was a cylinder of radius 14 $\pm$ 1 cm. with a semi-spherical end. The data are not adequate to make a reasonable deduction of the shape of the other end.

The average thickness of the fragments is about 1.9 mm.; a number of pieces are however of 3.6 mm. thick, and according to their appearance the thicker fragments seemed to be those of the rim of the vessel. Several pieces present more complex curvature. Other fragments have grooves on their inner concave surfaces, possibly due to the fact that the calcareous material was supported by wide strips in its manufacturing processes.

The convex surface of the fragments is silvery white in color and is covered with aluminium paint. The main substance of the fragments seems to consist of calcareous material, light greyish yellow in color. The concave inner surface is polished but with minute pores on it. It seems that the calcareous material was pasted on a smooth surface. There are still traces of aluminium painted calcareous material on the outer surface of the cap of the bomb. The thickness of the calcareous material gradually thinned out toward the vertex of the cap.

(3) Based on the above-mentioned observations and measurements we think the figure on p. 321 may represent a part of the bomb.

(4) The rim of the metallic cap showed evidence of soldering, but the part of the bomb which was soldered to it was not revealed.

(5) The calcareous material is very brittle. Suppose the bomb is 40 cm. long, the calcareous vessel itself would weigh up to two kilograms. In addition, the contents in the vessel would mean more weight on it. It seems to be very difficult for such brittle calcareous material to hold all the weights together.

Chao Chun-yao
Research Member
Ho Za-wei
Research Member
Yeh Ming-han
Research Assistant

June 10, 1952

Tsien San-tsiang
Director

June 22, 1952

Institute of Modern Physics, Academia Sinica

DOCUMENT V-1b

REPORT ON X-RAY ANALYSIS

I. Description of the specimen:

The specimen consists of two layers, one being a metallic thin foil, while the other a sintered light brown mineral-substance.

II. Procedure:

The specimen was pulverized first, and the powder thus obtained was rolled on to a fine glass fibre with Canadian balsam. It was then fitted into a 9 cm. powder camera. The X-ray radiation used was CuK α with 50 KV & 12 ma. A Ni foil was used to filter off the CuK β . The exposure was 50 minutes.

The distances between corresponding pairs of lines of the Debye-Scherrer photograph were measured by a comparator. With the constant of the camera known the spacings, d, of the corresponding lines were calculated. The relative intensities of the lines were estimated visually, while those of the principal ones checked with microphotometric measurement.

The experimental data is tabulated below. Comparing with X-ray Diffraction Data Card No. 1-0837 compiled by A.S.T.M. (American Society of Testing Materials) it is concluded that the main constituent of the specimen is calcite, $CaCO_3$. Card 3-0696 shows further that the minor constituent in the sample is clinoenstatite, $MgO.SiO_2$.

III. Experimental data & result:

Experimental data		A.S.T.M. *Card 1-0837*		A.S.T.M. *Card 3-0696*	
lattice spacing d (A.U.)	relative intensity I/I_1	lattice spacing d (A.U.)	relative intensity I/I_1	lattice spacing d (A.U.)	relative intensity I/I_1
1.15	10	1.15	5		
1.17	7	1.18	3		
1.225	3				
1.235	2	1.24	3		
1.29	8	1.30	5		
1.33	2				
1.34	1	1.35	3	1.37	70
1.41	7	1.43	5		
1.435	10	1.44	8		
1.46	5	1.48	5	1.46	40

1.52	20	1.51	12	1.52	40
1.595	15	1.60	16		
1.61	3			1.60	80
1.865	22	1.87	24		
1.91	28.5	1.92	32		
2.09	22	2.09	20	2.10	60
2.27	27	2.28	24		
2.49	17.5	2.49	20		
2.87	4			2.87	100
3.02	100	3.04	100	2.97	90
3.35	2			3.16	60
				3.28	60
3.82	7	3.86	8		

Result:

	Principal Constituent	Minor Constituent
	Calcite	Clinoenstatite
	$CaCO_3$	$MgO.SiO_2$

Woo Chien-chang
Assistant Research Member
June 15, 1952

Lu Shio-shan
Acting Director
June 20, 1952

Institute of Applied Physics, Academia Sinica

DOCUMENT V-1c

REPORT ON SPECTROGRAPHIC ANALYSIS

Date: June 14, 1952
Sample: Bacterial Bomb
Instrument: Adam Hilger Quartz Spectrograph E1, Spectral region $\lambda\lambda$ 2600-4200Å
Source: D. C. Arc, Voltage 130V, current 5 amp.
Electrode: Carbon rod, 5 mm in diameter 8 cm in length

(1) The analysis of the head portion of the bomb:—

(a) Processes:

The material to be analysed was, as usual, put into the small hole of the lower carbon electrode. When the current passed through the electrical circuit, the sample under analysis was excited. Photographs were then taken.

Just above and below the spectra of the sample, the spectra of pure iron and carbon were taken respectively for comparison.

(b) Results:

A large number of iron lines were found in the spectra. Besides, the existence of zinc, manganese, copper, and tin was identified.

Elements:	Lines identified (Å)
Fe	many
Zn	3282.3, 3302.6, 3345.0, ...
Mn	2933.1, 2939.3, 2949.2, 4030.7, 4033.0, 4034.5, ...
Cu	3247.5, 3273.9, ...
Sn	2863.3, 3009.1, 3034.1, 3175.0, ...

(2) The analyses of solder and aluminium paint and plaster:

(a) Processes were the same as in (1).

(b) Results: The major components of the solder were tin and lead, thus proving that it was an ordinary solder.

Elements	Lines identified (Å)
Sn	2706.5, 2840.0, 2863.3, 3175.1, 3262.3, 3801.0,
Pb	2802.0, 2823.2, 2833.1, 2873.3, 3572.7, 3683.5, 4057.8, ...

The aluminium paint and plaster consist of calcium, magnesium and aluminium as major constituents, and tin as minor constituent. The lines identified were as follows:

Elements	Lines identified (Å)
Ca	3158.9, 3179.3, 3344.5, 3350.2, 3933.7, 3968.5, 3973.7, ...
Mg	2795.5, 2802.7, 2852.1, 3093.0, 3096.9, 3332.2, 3336.7, 3829.4, ...
Al	2660.4, 3066.2, 3082.2, 3092.7, 3944.0, 3961.5, ...
Sn	2863.3, 3009.1, 3175.0, 3262.3.

After the metallic aluminum paint on the outer surface of the calcareous fragment was removed, samples from three different parts of a fragment were scraped off for analysis; namely a layer each of about 0.2 mm. from the outer surface and the inner surface, and a layer about 0.3 mm. from the groove on its inner surface. The results showed that the three different parts of the plaster have the same composition. Calcium and magnesium were the principal constituents, and tin the minor one. From this it can be deduced that aluminium is present only in the aluminum paint.

The lines identified were the same as those of Ca, Mg. and Sn in the above table.

Chang Chih-san
Assistant Research Member
June 14,1952

Lu Sho-shan
Acting Director
June 20, 1952

Institute of Applied Physics, Academia Sinica

DOCUMENT V-2

REPORT ON CHEMICAL ANALYSIS

Specimen No.	Qualitative and Quantitative	Date received: April 12, 1952
Specimen sent from	Ministry of Health, People's Government of Northeast China	Date reported: April 15, 1952
Source / Kinds of Specimen / Result of analysis	Fragments of bacterial bomb	
Physical properties	Light; brittle; light yellow in color; with a thin layer of silvery paint on the outer surface.	
Chemical properties	1. Weight lost on ignition (around 500°C) .... 10.58% 2. Aluminum paint .... 1.52% 3. Amorphous calcium carbonate ($CaCO_3$) .... 86.18% 4. Other substances (Silicon oxide SiO_2, Ferric oxide Fe_2O_3, Aluminium oxide Al_2O_3, magnesium oxide MgO) 1.72%	
Procedures	The specimen was ignited at 500°C until its weight became constant. The weight lost on ignition represented that of water and organic material. The thin layer of aluminum paint dropped off from the bomb fragments. After the aluminum layer was separated from the specimen, it was weighed again. The specimen after ignition was dissolved in hydrochloric acid (HCl), ammonium oxalate $(NH_4)_2 C_2O_4$ was added to precipitate calcium (Ca); and it was then titrated with potassium permanganate ($KMnO_4$). The percentage of other substances was obtained by subtracting items 1, 2 and 3 from 100%. Procedures for qualitative analysis omitted.	
Comment	The bomb fragments are chiefly composed of amorphous calcium carbonate, mixed with gelatin. The outside silvery white thin layer is aluminum paint.	
Remarks	The weight lost on ignition represented that of water and organic material of which a greater portion was an adhesive agent made of gelatin and a smaller portion represented the solvent and adhesive agent for the aluminum paint.	

Wu Heng
Director
Institute of Science, Ministry of Industries,
People's Government of Northeast China

Chang Yu-ch'ang,
Director of Chemical Labortory
Yuan Hsiu-shun,
Technical Assistant

DOCUMENT V-3

REPORT ON ENTOMOLOGICAL IDENTIFICATION

Specimen No. 48003	Original Specimen No.	Date received: March 24, 1952

Facts about the discovery of the specimen:

On March 21, a bacterial bomb dropped by an American military plane was found outside the east gate of K'uan-tien, in the area of Lou-ho-t'ao. Flies and spiders were found near the bomb crater.

Results of identification:

Scientific name: **Hylemyia (Chortophila)** sp.

Common name: Anthomyiid fly

Comment: Under natural conditions, the flies of this genus begin to appear normally in about April and May. Now that these flies appeared in March when the ground was still covered with snow and they were found in large numbers on the snow near the bacterial bomb crater, undoubtedly they were related with the U.S. military airplane.

Remarks:

Identified by:

CHEN SICIEN H. Dr. Univ. Paris, Director of Laboratory of Entomology, Academia Sinica.

LU PAO-LIN, M.S. Assistant Professor of Department of Entomology, Peking College of Agriculture.

Date of report: April 10th, 1952

DOCUMENT V-4

REPORT ON ENTOMOLOGICAL IDENTIFICATION

Specimen No. 48004B	Original Specimen No.	Date received: March 24, 1952

Facts about the discovery of the specimen:

On March 21st, a bacterial bomb dropped by the U.S. military plane was found outside the east gate of K'uan-tien, in the area of Lou-ho-t'ao. Flies and spiders were found near the bomb crater.

Results of identification:

Scientific name: **Tarentula** sp.
Common name: Wolf spider
Comment: The average temperature at that time was 0.6 degree C. At some places snow remained unmelt. Under such natural conditions, the spiders should not have appeared in such a large number. Besides, these specimens were found near the bacterial bomb crater. Evidently they were related with the bomb dropped by the U.S. military airplane.

Remarks:

Identified by:
WANG FENG-CHEN D.Sc., Professor, Army Medical College, Tientsin
Date of report: April 8th, 1952

DOCUMENT V-5

REPORT ON BACTERIOLOGICAL EXAMINATION

1. No. of specimen: 48003
2. Source of specimen: K'uan-tien
3. Date received: March 24, 1952.
4. Kind of specimen: anthomyiid flies.
5. Procedure: After the specimen was received, 6 anthomyiid flies were washed with 3 ml. of sterile normal saline for 3 minutes. The flies were removed with sterile forceps and the saline washing was then used for the following cultures and animal inoculations.

A. Two white mice were used, each received 0.3 ml. of the washing subcutaneously. On the next day, one died. On autopsy, Gram positive, square-ended, large bacilli were demonstrated in spleen, liver and heart blood by the direct smear method. Capsules were demonstrated, by capsular staining technique. From the heart blood a pure culture was isolated.

B. Culture of the Saline washing:

(1) Blood agar plate: Two drops of the washing were streaked on the plate, which was then incubated at 37°C for 24 hours. Examination revealed a large number of grayish white elevated colonies, each measuring about 2-3 mm. in diameter. The surface was rough and edge irregular showing an appearance of curled hairs. The colonies were not transparent. No hemolysis. Stained smear examinations revealed large Gram-positive, square-ended bacilli, arranged in chains. There were centrally located spores. Pure culture was made on agar slant.

(2) Plain agar plate: Two drops of the washing were streaked on the plate, and the same results as above were obtained.

(3) Kauffmann medium: 1 ml. of the saline washing was inoculated into Kauffmann medium. After 24 hours incubation at 37°C, it was then transferred to Endo's medium.

C. Three of the above washed flies were crushed in Kauffmann medium. After 24 hours incubation at 37°C it was streaked on Endo's medium. No pathogenic bacteria of the enteric group were found.

D. The other three of the flies were crushed in the meat broth and two drops of the suspension were streaked on a plain agar plate and a blood agar plate. They were then incubated at 37°C for 24 hours. On both plain and blood agar plates, there were large numbers of grayish white elevated colonies with rough surface and irregular edge showing an appearance like curled hairs. No hemolysis. Stained smear showed that they are composed of Gram-positive, square-ended, large bacilli with spore formation. The growth was used for pure culture. In the meat broth, after 24 hours incubation at 37°C there were Gram-positive bacilli and some contaminants.

Isolation of Bacteria Carried by Anthomyiid Flies:

Six anthomyiid flies

- Washing fluid, 3 ml.
  - Mice injected subcutaneously with 0.3 ml. ...... died after 24 hours ...... encapsulated, Gram positive, large bacilli with square ends
  - Culture on plain agar plate and blood agar plate ...... typical colonies ...... Gram positive large bacilli with square ends, lined in chains, with centrally placed spores
  - Washing fluid 1 ml. added to Kauffmann medium, incubated at 37°C for 24 hours ...... Culture on Endo's medium
- 3 flies crushed in Kauffmann medium ...... 37°C, 24 hours for enrichment ...... Culture on Endo's medium
- 3 others crushed in meat broth
  - ↓ streaxing on plain agar plate, on blood agar plate — 37°C, 24 hours ...... typical colonies ...... Gram positive large bacilli with square ends, lined in chains, with centrally placed spores

For Pure Culture Examinations

6. Examination of the pure culture:

I. Morphology: Gram-positive, large bacilli with square-ends and a central spore formation. arranged in chains. Hanging drop examination revealed no motility of the organism.

II. Cultural Properties:

(1) Plain agar plate: Colonies opaque; surface rough; edge irregular like curled hairs.

(2) Bouillon: Growth with flocculent precipitation. The supernatant fluid clear. No pellicle formation.

(3) Blood agar plate: The appearance of colonies were the same as on other media. No hemolysis.

(4) Gelatin medium: 24 hour stabbed culture showed inverted fir tree-like growth. Gelatin liquefied gradually after several days.

(5) Milk medium: Coagulated.

III. Biochemical Properties:

Indole reaction	(—)	Mannitol	(—)
Lactose	(—)	Xylose	(—)
Glucose	(+)	Inositol	(—)
Maltose	(+)	Arabinose	(—)
Sucrose	(+)	Salicin	(—)
Dulcitol	(—)	Hydrogen sulfide	(—)

IV. Hemolytic Reaction:

Three 2 percent saline suspensions were made separately with the red blood cells of goat, guinea pig and rabbit. Each of these suspensions was then mixed with a suspension of this bacterial culture (1 loopful/ml.). Incubated for 2 hours and they were examined for hemolysis. Control examinations were made with *Bacillus subtilis*. The results are tabulated as follows:

Bacterial suspension / 2% R.B.C. susp.	Present specimen	Control test with *B. subtilis*
Rabbit'	No hemolysis	Hemolysis
Guinea Pig	No hemolysis	Hemolysis
Goat	No hemolysis	Hemolysis

V. Pathogenicity tests: A saline suspension was made with the present specimen of bacteria (1 loopful/ml.). Into each of two white mice, 0.2 ml. of the suspension was injected intraperitoneally and into each of two guinea pigs 0.5 ml. was given subcutaneously. Mice died in 18 hours and guinea pigs died in 2 days. Autopsy on these dead animals revealed enlargement of both liver and spleen. From the heart blood, spleen and liver, Gram positive, square-ended, large bacilli with capsule formation were observed. On culturing, the same kind of organism as the original one was obtained.

VI. Serological examinations:

A piece of liver and spleen of a dead guinea-pig was ground separately and diluted with saline. After boiling for 30 minutes, Ascoli precipitation test was carried out with the supernatant filtered, clear fluid. The liver and spleen of a healthy guinea-pig were used as control.

Antigen / Serum	Dead Guinea-pig		Healthy Guinea-pig		Saline
	Liver	Spleen	Liver	Spleen	
Anti-Anthrax serum	(+)	(+)	(—)	(—)	(—)
Normal rabbit serum	(—)	(—)	(—)	(—)	(—)

VII. Conclusion:

Bacillus anthracis has been isolated from both the washing saline and the ground material obtained from the anthomyiid flies.

Examined by: Hsin Chun, M.D.
Chao Lin, M.B.

Reported by: Hsin Chun, M.D.
Chief Technical Expert
Northeast Epidemic Prevention Institute

April 14, 1952

DOCUMENT V-6

REPORT ON BACTERIOLOGICAL EXAMINATION

1. No. of specimen: 48004 B
2. Source of specimen: K'uan-tien
3. Date received: March 24, 1952
4. Kinds of specimen: Wolf spiders
5. Procedures: After receiving the specimen, 3 spiders were washed

   in 3 ml. of sterile normal saline for 3 minutes. They were then taken out with sterile forceps and ground in a sterile mortar with another 3 ml. of sterile normal saline. The fluid was centrifuged at a speed of 2,000 revolutions per minute for 15 minutes. The washing fluid and the sediments were then inoculated into various culture media. At the same time, the washing fluid was injected subcutaneously into 2 white mice, each receiving 0.3 ml.

The media used were: (1) plain agar plate, (2) blood agar plate, (3) Kauffmann's enrichment medium and (4) minced meat medium. The above media were examined after incubation at 37°C for 24 hours.

On plain and blood agar plates inoculated with the washing fluid and the sediments, there grew a rather large number of elevated colonies with rough surfaces, each with a diameter of about 2-3 mm. Under the magnifying lens, the edges of these colonies were curled hair-like in appearance. Those colonies on the blood agar plate showed no hemolysis. Hanging drop examination revealed no motility. Microscopic examination of the stained smear revealed Gram positive square ended bacilli with central spore formation. These bacilli were then fished out for pure culture, because on the media, there were also growth of a small number of micrococci and staphylococci. One of the two injected mice died in 24 hrs. On autopsy, the liver, spleen, lungs and heart blood were found to have square-ended Gram-positive bacilli, which showed capsular formation when stained with Hiss' capsule stain. From the tissues of the mouse culture was again made, using plain agar plate and blood agar plate and pure culture of the bacilli was obtained.

Isolation of bacteria carried by wolf spiders:

3 spiders

Ground with 3 ml. saline

Centrifuged for 15' (at 2,000 r.p.m.)

sediment

Kauffmann's medium 2 loopfuls
Minced meat medium 2 loopfuls

Plain agar plate
Blood agar plate

37°C, 24 hrs.

Typical colonies

Gram positive large bacilli with square ends and central spore formation

Washed with 3 ml. saline

Minced meat medium inoculated with 1 ml.

Kauffmann's medium inoculated with 1 ml.

37°C, 24 hrs.

Blood agar plate

Plain agar plate

37°C, 24 hrs.

Typical colonies

Gram positive large bacilli with square ends and central spore formation

Subcutaneous injection into 2 white mice each 0.3 ml.

One died 24 hrs.

Large Gram positive bacilli with square ends and capsules

For pure culture examinations

6. Examination of pure culture:

I. Morphology:

Gram-positive, large bacilli with square ends and central spore formation, linked in the form of a chain. Hanging drop examination revealed no motility.

II. Cultural Properties:

(1) Plain agar plate: Opaque colonies with rough surfaces; edge irregular, like curled hairs under magnifying lens.

(2) Meat broth: Growth with flocculent precipitation. Clear supernatant fluid. No pellicle formation.

(3) Blood agar plate: The appearance of colonies were the same as on the plain agar plate. No hemolysis.

(4) Gelatin medium: Stab culture showed 24 hours later inverted fir tree-like growth which liquefied gradually after four days.

(5) Milk medium: Coagulated on the third day.

III. Biochemical Properties: A pure culture of this bacillus was inoculated into various sugar tubes, (peptone water containing sugar and bromthymol blue). Results:

Indol reaction	(—)	Mannitol	(—)
Lactose	(—)	Xylose	(—)
Glucose	(+)	Inositol	(—)
Maltose	(+)	Arabinose	(—)
Sucrose	(+)	Salicin	(—)
Dulcitol	(—)	Hydrogen sulfide	(—)

IV. Hemolytic Reaction:

Three 2% suspensions of red blood cells in saline were made separately with the blood taken from a goat, guinea pig and rabbit. One ml. of each of these suspensions was then mixed with a suspension of this bacterial culture (1 loopful/ml.). The mixtures were incubated for 2 hours and were then examined for hemolysis. Controls were made with *Bacillus subtilis*.

Bacterial suspension / 2% R.B.C. suspension	Present specimen	Control tests with *B. subtilis*
Rabbit	No hemolysis	Hemolysis
Guinea pig	No hemolysis	Hemolysis
Goat	No hemolysis	Hemolysis

V. Pathogenicity Tests: A saline suspension was made with the present specimen of bacteria (1 loopful/ml.). Into each of the two white mice, 0.2 ml. of the suspension was injected subcutaneously and into each of the two guinea pigs 0.5 ml. was given subcutaneously. Mice died in 18 hours and guinea pigs died in 3 days. Autopsy of these dead animals revealed gelatinous exudate in the inoculated region, and enlargement of both liver and spleen. From the heart blood, spleen and liver, large Gram positive bacilli with square ends and capsule formation were observed. The same kind of bacillus as the original one was thus isolated.

VI. Serological Examinations:

A piece of liver and spleen of a dead guinea pig was ground separately and diluted with saline (4 X). After boiling for 30 minutes. Ascoli precipitation test was carried out with the clear supernatant fluids, (using anti-anthrax diagnostic serum made by the Veterinary Research Institute of Harbin). The liver and spleen of a healthy animal were used as controls.

Serum \ Antigen	Dead Guinea-pig		Healthy Guinea-pig		Saline
	Liver	Spleen	Liver	Spleen	
Anti-anthrax	(+)	(+)	(—)	(—)	(—)
Normal rabbit serum	(—)	(—)	(—)	(—)	(—)

VII. Conclusion:

Bacillus anthracis has been isolated from both the washing saline and the ground material made of the wolf spiders.

Examined by Hsin Chün, M. D.
Chao·Lin

Reported by Hsin Chün, M. D.,
Chief Technical Expert of Northeast
Epidemic Prevention Institute

Date Reported: April 14, 1952

DOCUMENT V-7

REPORT ON BACTERIOLOGICAL EXAMINATION

Specimen No. 355

Date received; April 14th, 1952.

Kinds of specimen: Feathers

Sources: K'uan-tien

Methods of bacteriological examination: A feather was cut with a pair of sterilized scissors into small fragments and washed with 10 ml. sterile physiologic saline. The washing fluid was centrifuged at 3,000 r.p.m. for 20 min. The sediments were inoculated on plain agar plate, blood agar plate, S S agar plate and meat broth.

Results of examinations: Observations after 24 hours incubation showed growth on blood agar and plain agar. The colonies were grayish white, with rough surface and irregular edges. No hemolysis. Stained smears showed Gram positive bacilli with square ends, lined up in chains. The growth was transferred to serum bouillon, and observation after 6 hours revealed no motility. Further transfer into various sugar tubes and special media showed the following characteristics:

1. Bouillon—Growth with flocculent sediments
2. Milk—Coagulated
3. Methylene blue reduction test—Negative
4. Sugar fermentation reactions:
   It fermented glucose, maltose and sucrose, producing acid but no gas.
   It did not ferment lactose, mannitol, dulcitol, inositol, xylose, arabinose and salicin.
5. No production of indol and hydrogen sulfide
6. Hemolytic test—Negative.

A 24 hour pure culture on a slant was washed with 5 ml. of sterile physiologic saline, and O. 1 ml. was injected subcutaneously into a guinea pig. This guinea pig died within 30 hours. On autopsy, the spleen was found to be enlarged to about 5 times its normal size, and there was gelatinous change at the site of inoculation. Smears made from heart blood and the site of inoculation both revealed Gram positive bacilli with capsules. Same type of bacteria was obtained by culturing the heart blood.

At the same time, the suspension made by washing the slant was diluted to 1:10, 1:100, and 0.3 ml. of each dilution was injected intraperitoneally into white mice. All the white mice died within 28 hours. Direct smears made from heart blood revealed Gram positive encapsulated bacilli and cultures showed the same kind of bacteria. Ascoli test: Positive.

Conclusion: *Bacillus anthracis* isolated from the feathers.

Examined by:
Wang Chin-tung

Reported by:
Hsieh Shao-wen (Samuel Zia), M.D.
Professor,

Chang Nai-chu, M.D.
Assistant Professor
Department of Bacteriology,
China Union Medical College

DOCUMENT V-8

DR. MA SHIH-CHUN'S STATEMENT

I am an entomologist working in Academia Sinica. I was with Dr. Liu Chung-lo, another entomologist, investigating the spot where fragments of the bacterial bomb were discovered at K'uan-tien. A few days previous to the discovery of the bomb, I went to collect insects twice in the neighbourhood of the area. Now I wish to give a brief report on the facts seen at that time and the results of investigation.

I had been at K'uan-tien three times. The first time, I was sent to that place by Academia Sinica to investigate into the insects disseminated by the U.S. military airplanes, and to collect specimens on March 18, 1952. The second time, I accompanied the Commission for Investigating the Crime of Bacteriological Warfare Committed by the American Imperialists, Northeast China Group, for further investigation, on March 20th and the morning of 21st. On both trips I visited the area outside the east gate of that city but did not go to Lou-ho-t'ao. The third time, I was there with Dr. Liu Chung-lo on the next day following the discovery of the fragments of the bacteria bomb (i.e., on the 22nd) for an on-the-spot investigation at Lou-ho-t'ao. After having interviewed Han Yung-pin, the grocer's assistant and Li Ssu-chien, the school boy, we were able to verify that the former's report on the air invasion checked well with the latter's discovery of the bomb fragments.

The flies and spiders which I collected on the three trips outside the east gate and its neighbouring area and large numbers of those collected on March 13th, 14th and 15th by the local inhabitants, have been identified by entomologists Dr. Ch'en Sicien H. and Prof. Lu Pao-ling and Wang Feng-chen, specialist in arachnida, as anthomyiid flies (*Hylemyia* sp.) and wolf spiders (*Tarentula* sp).

These anthomyiid flies and wolf spiders were found in abundance in the snow-covered fields in the neighbouring district outside the east gate only after the day when Han Yung-pin witnessed an American military plane dropping the bacteria bomb. It snowed when we went to examine the crater at Lou-ho-t'ao on March 22nd. Observations were made possible only after melting the snow with hot water (There is photograph for reference). Then, the bomb crater, the bomb fragments and feathers, were all exposed. In addition anthomyiid flies were discovered on corn stalks near the crater. According to entomological knowledge, it is impossible for these anthomyiid flies and wolf spiders to appear naturally in such a season, at such places as snow-covered fields, and in such

large numbers. Therefore, it can be affirmed that those anthomyiid flies and wolf spiders were evidently closely related with the bacteria bomb.

We have sent portions of the specimens collected on March 18th, 20th, 21st and 22nd to the Department of Bacteriology of National Medical College, Shenyang, where they were proved to carry *Bacillus anthracis* by bacteriologists.

Fig. 1. Fragments, iron axis and steel plate of the calcareous bacterial bomb.

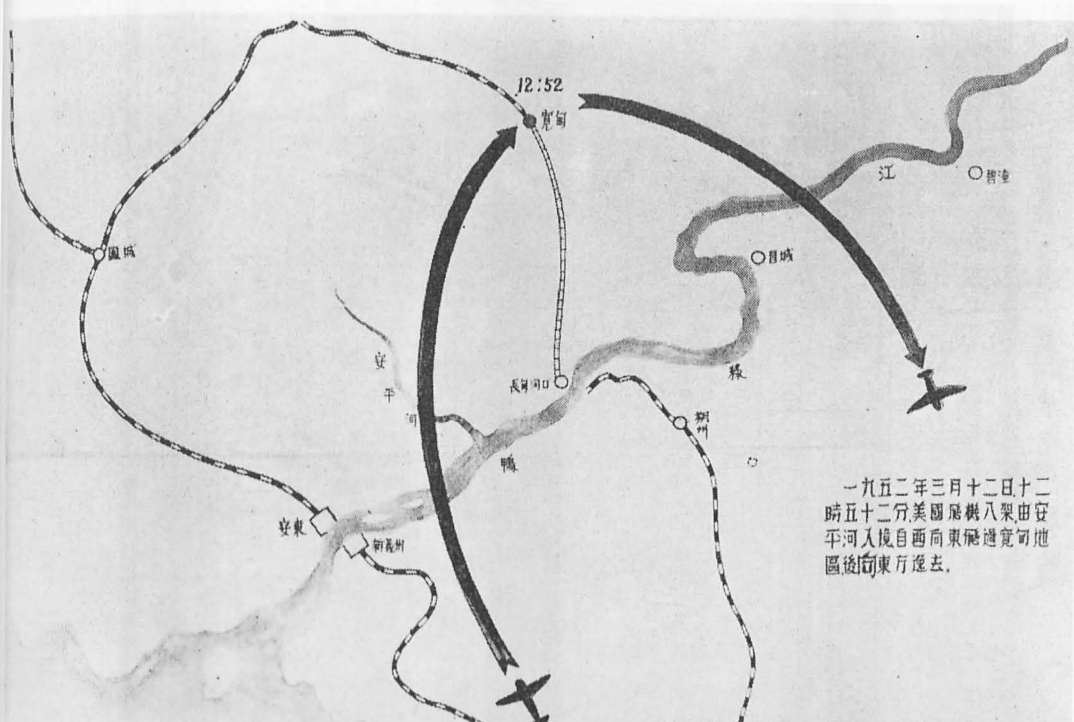


Fig. 2. Chart showing the course of American planes intruding over K'uan-Tien on March 12, 1952.

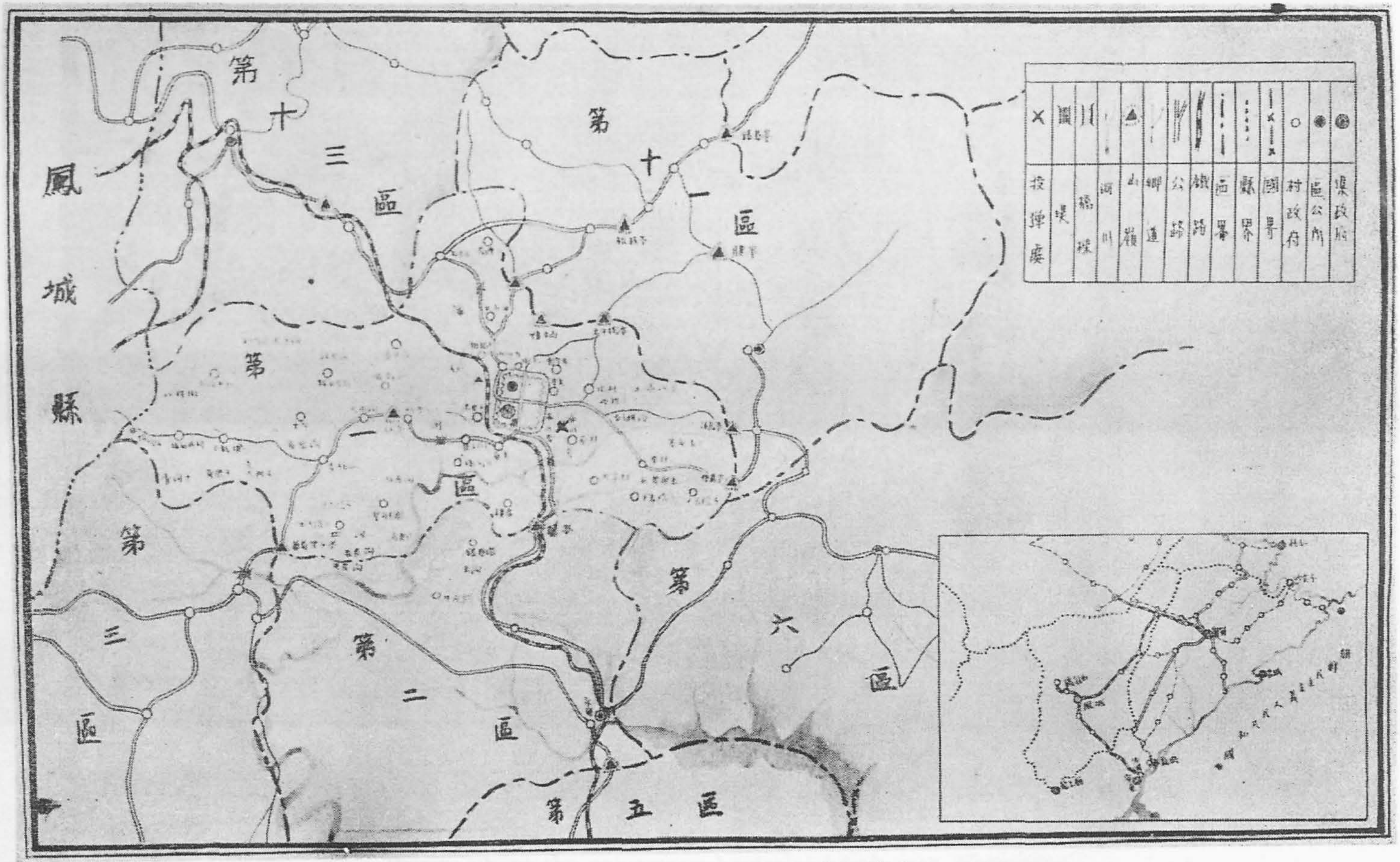


Fig. 3. Map of K'uan-Tien Hsien.

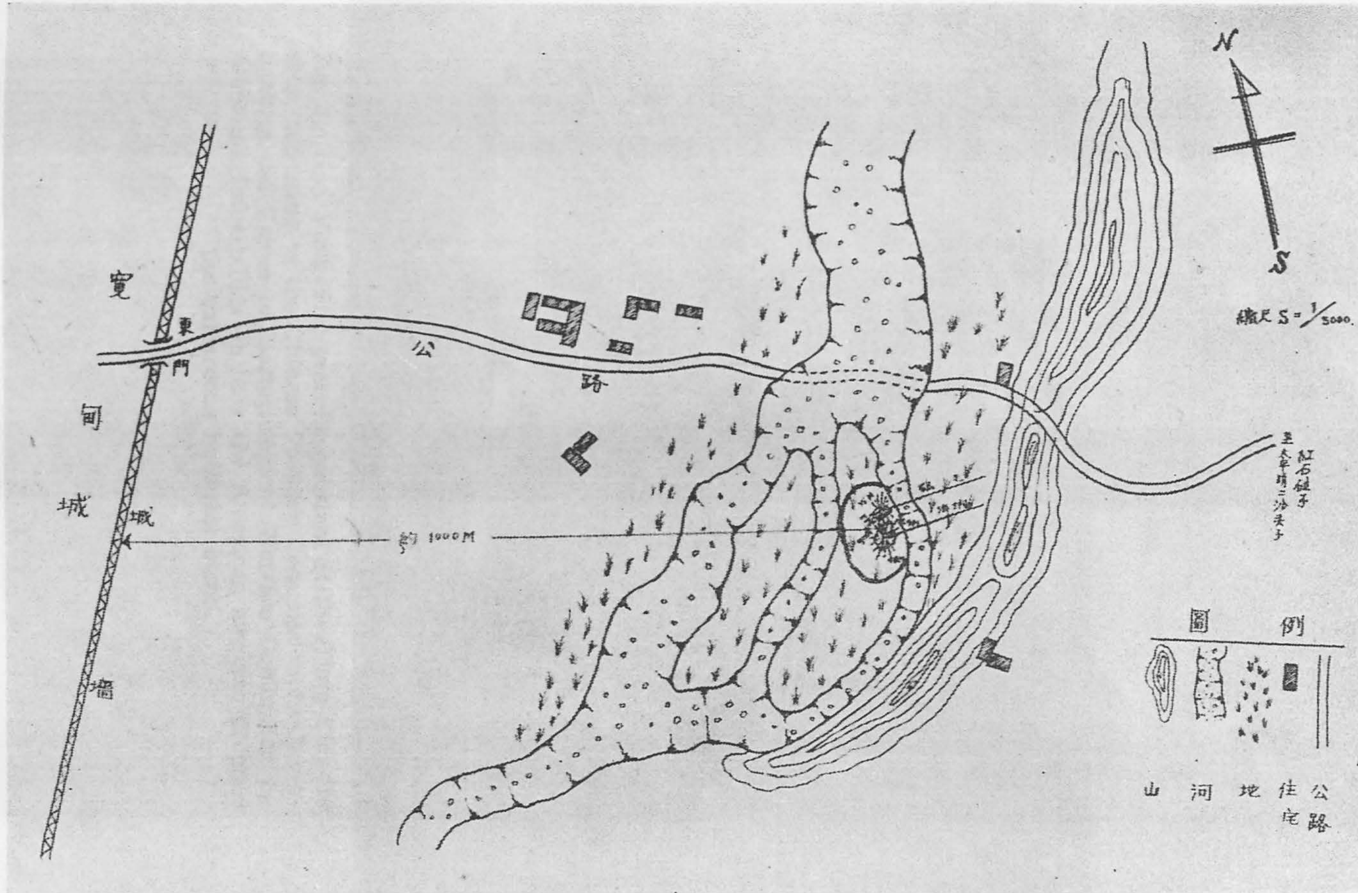


Fig. 4. Diagram depicting the locality near the road to Lou-Ho-Tao, K'uan-Tien Hsien, where the calcareous bacterial bomb was discovered.

Fig. 5. Han Yung-Pin, grocer's assistant of the Tung-Chu-Ho shop, reporting to the Chinese People's Commission for Investigating the Crime of Bacteriological Warfare Committed by American Imperialists on how the American airplane dropped the calcareous bacterial bomb.

Fig. 6. Li Shih-Chien, a school boy in the K'uan-Tien Middle School, demonstrating to the Chinese Commission his discovery of the calcareous bacterial bomb.

Fig. 7. Members of the Chinese Commission investigating the point of impact of the calcareous bacterial bomb.

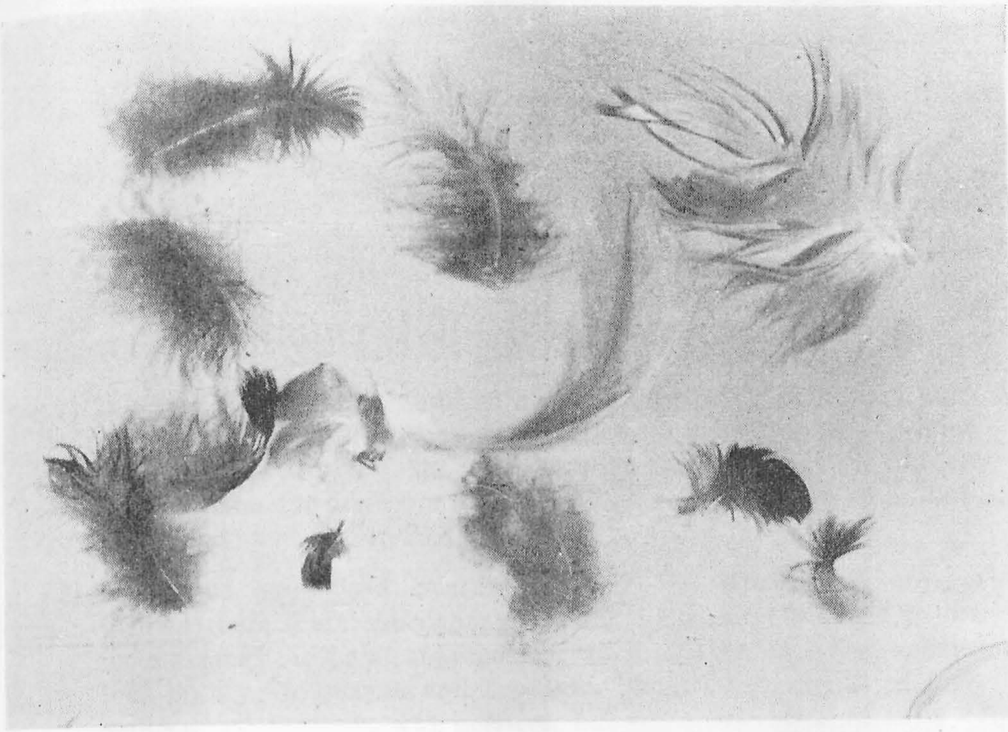


Fig. 8. Feathers found near the bomb-pit.

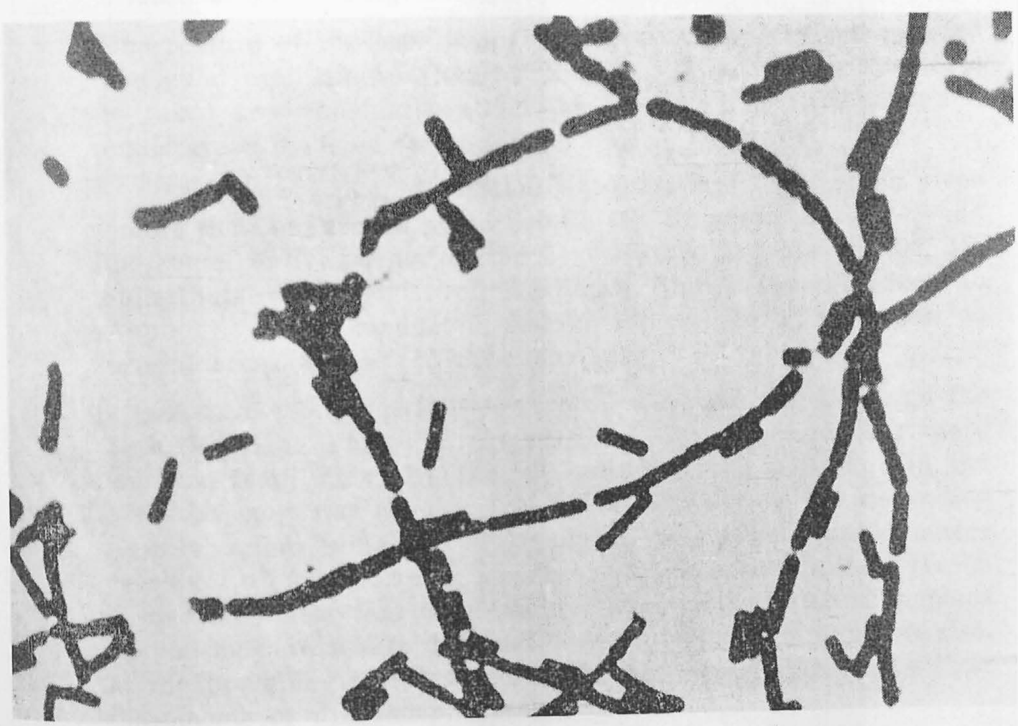


Fig. 9. *Bacillus anthracis* isolated from the feathers.

APPENDIX W

Commentary on the Case of the "Eggshell" Container Found at K'uan-Tien

1) It was verified that this case was the same as that already succinctly described in Documents SIA/3, p. 2 and in the printed version of the Report of the NE China sub-commission of the Chinese "Commission for Investigating the American Crime of Germ Warfare," p. 2; and also in SIA/8, p. 6.

2) This case comprised positive evidence of planes and objects thrown from them subsequently found. The insects found in the zone around the point of impact of the projectile were also anomalous both as to season and species. Bacteriological test of flies, spiders and feathers was positive, but there had been no cases of disease believed to have originated from the incident.

3) One feature of the case was that the container fragments were not found until nine days after the incident. It might therefore be asked how the feathers and the insects could have remained undispersed by wind for so long a time.

   The answer to this question was contained in evidence given before the Commission by Li Ssu-Chien, the schoolboy who found the container fragments on the 21st March, and also by Dr. Ma Shih-Chün, entomologist of Academia Sinica (qualifications in App. TT), who conducted search for insects in the area on several occasions on and after the 18th.

   Asked what snowfalls took place between the 12th and the 18th, Mr. Han Yung-Pin, the grocer's assistant, said that there were no fresh snowfalls, though some fell on the 21st. On the 12th the snow was about 1 inch thick, and during the succeeding days it varied, being melted or blown away from exposed places or ridges of field furrows, and accummulating within the furrows. It was thus clear that the feathers could have remained in place within the snow where they had been protected. The insects also, at the prevailing temperature, would have been sluggish in their movements of dispersion. Dr. Ma concurred.

4) In the SIA Documents mentioned above, mention was made of mosquitoes and springtails (*Orthocladius* and *Isotoma* respectively). In reply to questions, Dr. Pai Hsi-Ch'ing explained that they did not now enter into consideration because bacteriological tests on them had proved negative.

5) Light on their finding, however, was thrown when Li Ssu-Chien described the organised battues for unusual insects organised by himself and his schoolmates. He himself could still find mosquitoes (more correctly, midges) and springtails, the day before his discovery of the container fragments, in the dried river-bed north of the road and the maize-field. In 2 hrs. 2 people caught 40 springtails and 7 mosquitoes on the snow.

During their searches the schoolboys tied up their sleeves and trouser ends with string, wore masks and carried special cardboard boxes for the specimens. They had searched in many other places besides the zone surrounding the point of impact, and had generally found a few insects, though not many. For example, outside the south gate of the city, he himself had found about 10 flies in 1 hr. in an area about 1½ km. from the subsequently-discovered impact point. This was on the 8th March, before the incident in question. All these insects, though living, were moving feebly. They were often in the clefts beside stubble stalks, and in the hollows of stalks themselves. They were subsequently identified, said Dr. Ma, as *Muscina stabulans* and *Isotoma negishina*.

The fact that finds were made before the 12th was to be explained, Mr. Liao Cheng-Chih pointed out, by the fact that air interventions in the district had begun a good deal earlier, about Feb. 29th. Dr. Ma said that on the 5th, 6th and 7th of March, the people of K'uan-Tien city searched assiduously for strange insects in the fields south of the south gate and southeast of the city, and obtained a good many. During the first week of March there were five air-raids over K'uan-Tien and its neighbourhood, with as many as 72 planes at one time, and in three of these cases there was reason to believe that insects were dropped though containers were not found. Until the 12th they were all *Muscina*, *Isotoma*, and *Helomyza*; only after that date did the anthomyiid fly, *Hylemyia*, and the spider, *Tarentula*, begin to turn up.

6) With regard to the zoning of *Hylemyia* and *Tarentula* around the point of impact, Li Ssu-Chien said that on the day of his discovery of the container fragments, he collected some 20 of the former

insect and 10 of the latter arachnid in the maize-field in the immediate neighbourhood of the point of impact among the stubble. Dr. Ma Shih-Chün had himself collected as many or more on the hillside across the dry river-bed from the field on the 18th. (i.e. before the point of impact was known), and he saw more which the local population had collected from the same place from the 13th to the 18th. When he came on the 22nd together with another entomologist Dr. Liu Chung-Lo, they melted the snow systematically with hot water around the point of impact to recover the container fragments, and at this time also they found another 20 flies down beside the stubble stems.

7) Additional information provided by the Chinese Air Observer Corps confirmed that the aircraft crossed the Yalu River after noon, and were over K'uan-Tien city at 12:52 p.m. March 12, 1952. They were F-86 jet planes in two waves of four aircraft each. Upon Mr. Han Yung-Pin being asked how he knew that they were American planes, he replied that they came over nearly every day, and that the people had got to know them extremely well.

8) Regarding the positive findings of *B. anthracis* on the feathers, Dr. Chang Nai-Ch'u stated that he had made control experiments on samples of ordinary feathers collected in and around the city of Peking, always with negative results. Dr. Hsin Chün had done the same thing from locations near Shenyang (Mukden) and K'uan-Tien, with similar results, (see App. E, F).

9) It was confirmed by Dr. Pai Hsi-Ch'ing and Mr. Liao Cheng-Chih that this type of container was the only one of the kind found up to that time.* Members of the Commission offered various suggestions as to the mechanism by which it had operated, pointing out that it seemed to have been modelled on the principle of the bird's egg-shell, as a considerable refinement on the earthenware containers or bombs for insects and bacterial cultures made by the Japanese "731" Detachment under Ishii Shiro, and still advocated (see App. Q). Specimens of these bombs, preserved from the ruins of the special factory at Harbin which made them, were inspected. Miss Yuan Hsiu-Shun, assistant to Dr. Chang Yu-Ch'ang, stated that upon being dried at high temperature, the fragments of the K'uan-Tien container gave off the odour of burnt protein; this would suggest the presence of gelatin as binding material in the calcareous case. Members of the Com-

* See, however, the Incident of June 6th (App-X).

mission suggested that the fragility of the container might be only a last-minute property, and that in fact it might have been formed upon a collodion mould, the collodion being subsequently removed by a solvent, before use. So also the grooves on the interior might have been filled with magnesium foil, which, though giving temporary support, would burn away without trace at the time of impact.

APPENDIX X

Note on the Incident of June 6th

28th June, 1952

The following information arises from a conversation with Mr. Wilfrid Burchett, correspondent of *Ce Soir*, Paris, on the evening of the 26th of June.

On the 6th, about 2 p.m. Burchett (B hereafter) was sitting in a jeep crossing an arm of the upper reaches of the Yalu R. on a ferry, when he noticed that the water was covered very thickly with insects. They were struggling to climb on to the ferry, which had a freeboard of about 2 ft., and swarming up through bolt-holes. The insects were of two kinds only, (A) a kind with a large and prominent black abdomen and constantly moving mouthparts, in total length about 1″, and (B) a kind which B thought corresponded to descriptions which he had heard of stone-flies.

Next day it transpired that these phenomena had coincided to within an hour with several others in the same region, and that these others had been accompanied by the passage of American planes. Containers were seen to come down near POW camps No. 2 and 3; and a further report of peasants stated that non-exploding bombs had fallen in the river and liberated insect swarms.

B talked to the principal of a village school near POW camp No. 2. The boys had been playing in the playground, when they heard planes, and as they were running in for shelter saw "silvery globes" coming down, apparently rather slowly in a diagonal direction. Later they went to the point of apparent landing, and found masses of insects. B talked to three of the boys, who confirmed these points and said that the shining globes were about twice as large as footballs. The insects were of type (A).

B finally visited Quinn and Enoch to check on the shining globes, but they could throw no light on them.

APPENDIX Y

Report on Four-Compartment Bombs Dropped by a U.S. Military Plane at Ch'ang-Pai Hsien, Liaotung Province

(ISCC/4)

Since March 27th, 1952, three four-compartment bombs were discovered one after another in Chia-Tsai-Shui Village, Ch'ang-Pai Hsien, Liaotung Province. In the neighbourhood of these four-compartment bombs, numerous flies, mosquitoes, fleas, crickets, springtails and spiders were discovered. The details are as follows:

In the evening of March 26th, 1952, at 8:57 p.m., an American airplane intruded Ta-Wei-Tzu hamlet near Chia-Tsai-Shui village, Ch'ang-Pai Hsien. Li Ming-Ch'êng, a farmer, heard the noise of the plane. As soon as he walked out of his house, he heard two thudding sounds as if something had been dropped. He suspected that it might be intelligence agents parachuted from the plane; and thus he reported the incident to the village administration.

Next morning (March 27th), the inhabitants of the whole village were mobilized to conduct a search. Li Ming-Ch'êng first discovered a four-compartment bomb about 150 meters to the west of his house.

On March 31st, Chiang Shu-te, another farmer of the village, found a second four-compartment bomb on the slope of a hill on the north bank of T'ieh-Hua-La-Tzu River near Ta-Wei-Tzu hamlet.

On April 1st, after 5:00 p.m., Chin Hsi-shan, a farmer of Ku-Shan-Tzu hamlet, Chia-Tsai-Shui Village, discovered the crater and shell of a third four-compartment bomb, when he went up the hillside to collect firewood.

Flies, mosquitoes, fleas, springtails, spiders and crickets were found near these four-compartment bombs. The discovery of these insects at a season when the ground was still covered by ice and snow was definitely an abnormal phenomenon.

The container itself is made of iron. Its total length is 149 cm. of which 8 cm. is the fuse, 113.2 cm. the body, and 27.8 cm. the tail. Its diameter is 36 cm. On the shell of the bomb, the following markings are noted: "EMPTY", "BOMB LEAFLET", "500 LB", and on the fuse: "U S TIME". The bomb has 4 compartments.

Regarding the use of the four-compartment bomb, the American government spokesmen have stated that, "this is merely a kind of propaganda bomb." But according to an A.P. dispatch of April 5, 1952, Robert Sikes, chairman of the House Appropriations Sub-Committee, told the press, after secret testimony from General Bullene, chief of the U.S. Army Chemical Corps, "The means of delivering germs to enemy territory, the General said, are simple and involve equipment of a type with which we are now already well stocked . . . such as containers used currently for dropping propaganda leaflets." The four-compartment bombs and various species of insects which were discovered at Ch'ang-Pai Hsien fully confirm that Bullene's methods as disclosed by Robert Sikes have been put into practice.

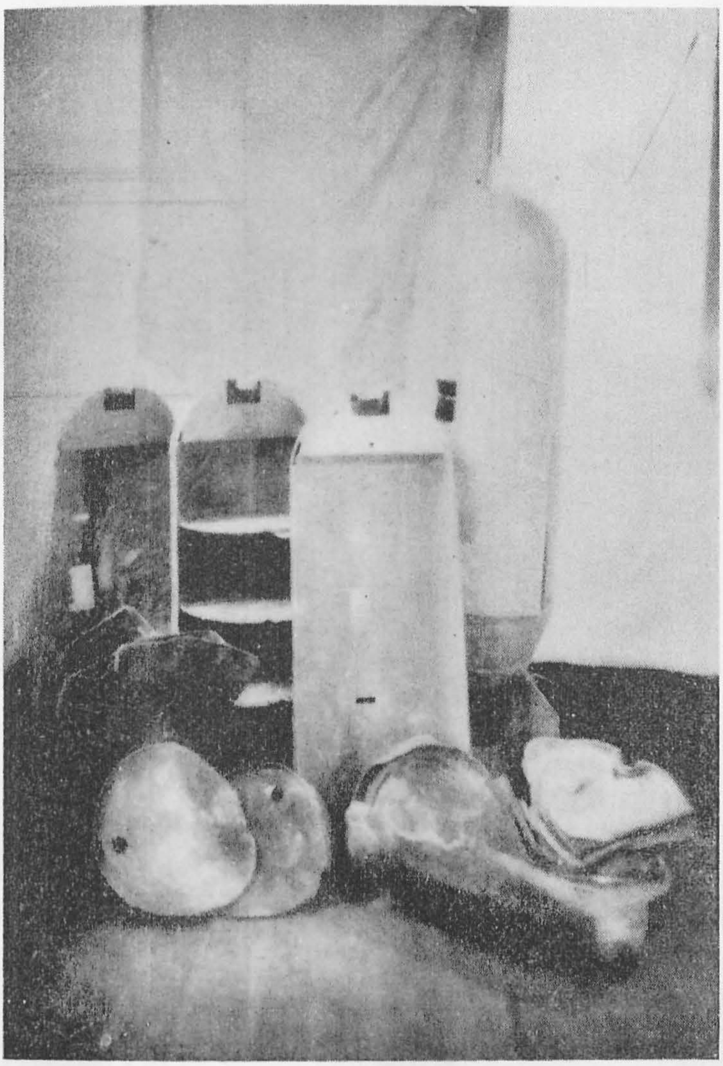


Fig. 1. Four-chambered bacterial bombs (leaflet bombs) dropped by American planes at Ta-Wai-Tsu Hamlet, Chia-Tsai-Shui Village, Ch'ang-Pai Hsien, Liaotung Province.

Fig. 2. Chart showing the course of the American plane intruding over Ch'ang-Pai on March 26, 1952.

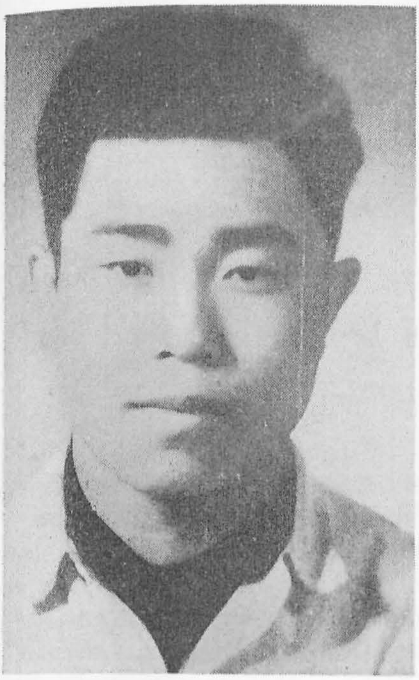


Fig. 3. Witnesses Chiang Shu-Te (upper left), Chin Hsi-Shan (upper right), Li Ming-Ch'eng (lower).

APPENDIX Z

Notes on Exhibits at Pyongyang of Containers Used by U.S. Armed Forces for Bacterial Warfare

(ISCK/7)

These are copies of the explanations for some of the bacterial bombs or containers shown in the "Exhibition Of the Criminal Acts Of Bacteriological Warfare Launched by the American Aggressors" held in Pyongyang City, North Korea, in June, 1952. They are not official reports. Nevertheless, they are statements of facts and can be used for reference. Do, goon, myon and li, are Korean words for province, hsien city, district and village, respectively.

No. 201

4-Chamber Bacterial Bomb

On March 5th, 1952, at midnight near Ryong Jou Li Moon-Chun Goon, Kang-Won Do comrade Sun Wei-Ch'iang, one of the Chinese Volunteers, noticed that American planes circling low overhead and heard four weak detonations. Early next morning he went out to search and found at a distance of about 300 yards from where he lived a large number of flies on the snow-covered slope of a mountain, scattered over an area of about 300 x 100 yards. The weather was cold and the chilled flies remained inactive on the ground. The shell of a 4-chamber bacterial bomb was also found on the slope of that mountain. The shell is exhibited here.

Witness and specimen collector: Sun Wei-Ch'iang.

No. 202

4-Chamber Bacterial Bomb

At about 9 p.m. on March 6th, 1952, an American plane circled low over Kum-Chon, Buk-San Li, Kang-Dong Goon, Pyong-An-Nam Do and dropped a bacterial bomb which exploded with a weak detonation. Soon after the plane had left, Sergeant Fang Chêng-Chang and several other sentries, with flash-lights in hand, ran toward the spot where the bomb had landed. They found, at a distance of about 150 yards, numerous flies scattered around the half shell of a 4-chamber bacterial bomb. The flies

were spread over an area of about 50-60 x 20-30 yards. At some dense spots, the snow was almost covered with flies.

Witness and specimen collector: Fang Chêng-Chang.

No. 203

4-Chamber Bacterial Bomb

An American plane dropped three 4-chamber bacterial bombs over Ma-sik-ryong, Duk-Won Myon, Moon-Chun Goon, around 4 a.m. on March 6th, 1952. They "exploded" and discharged large numbers of flies and spiders. One of the bombs is exhibited here.

Witness and specimen collector: Lu Tsung-Yu.

No. 204

4-Chamber Bacterial Bomb

During the night of March 21st, 1952, an American plane dropped this 4-chamber bacterial bomb over the southeast district of Yong-Ok Li, Moon-Sung Myon, Moon-Chun Goon, Kang-Won Do. Next morning a large number of flies were found to be present around it.

Witness and specimen collector: Lin Kuo-Tzu.

No. 205

4-Chamber Bacterial Bomb

On February 28th, 1952, at 8 p.m., an American plane dropped two bombs near Bo-Bang Li, Pyong-Won Goon, Pyong-an-Nam Do. which exploded without any loud detonation. Chen Kuang-Han and thirty other volunteers went out to search immediately. At a distance of about 200 yards they found two "exploded" 4-chamber bacterial bombs, one on the slope of a hill and the other in a cotton field. Many flies were seen crawling on the bombs and on the snow around. One of the two bomb shells is exhibited here.

Witness and specimen collector: Chen Kuang-Han.

No. 206

4-Chamber Bacterial Bomb

On March 26th, 1952, around 9 a.m. an American plane circled over Ma-Sang Li, Nyong-Won Myon, Nyong-Won Goon, Pyong-An Nam Do Comrade Han Lu-T'ao, an assistant medical officer, saw the plane diving and dropping two bombs. One landed at Ma-Sang Li, and made a crater 5 inches deep; the other landed about two thousand yards away. Both bomb shells were found split into halves. Each created an insect-congested

zone about 200 x 100 yards in length and breadth. At some dense spots there were more than one hundred flies per square yard, the most dense spot being nearest to the shells of the bombs. Some insects were seen still crawling out from the bomb casings at the time of discovery.

Witness and specimen collector: Dr. Han Lu-T'ao.

No. 207

4-Chamber Bacterial Bomb

This 4-chamber bacterial bomb was dropped by an American plane at Sung-Chun, Pyong-An-Nam Do on March 10th, 1952. Around four o'clock that morning an American plane circled low over Sung-Chun and dropped four bombs, one of which exploded with a weak detonation and landed on a hill rather less than a mile northeast of Sung-chun city. Comrades Chen Shiu-Shih and Tai Tzu-kuo, two clerks of a certain detachment, went to the spot to search, and found an "exploded" 4-chamber bacterial bomb. Its two half-shells were lying about 30 yards apart. For 50 yards around the shells of the bombs a large number of flies were seen on the surface of the snow. At some dense spots, there were 20-30 flies per square yard. The bomb-casings and some of the flies were collected by him as specimens.

Witness and specimen collector: Chen Shiu-Shih.

No. 208

4-Chamber Bacterial Bomb

During the night of February 26th, 1952, an American plane flew over Kum-Bong Li, Chung-San Myon, Pyong-Won Goon, Pyong-An-Nam Do, and dropped two 4-chamber bacterial bombs. They were discovered early next morning together with numerous flies on the snow near by. The mean temperature, according to the daily weather report, was 4°C below zero. One of these is exhibited here.

Witness: Han Byon-Soo.

Specimen collector: Kim Sung-Il.

No. 209

4-Chamber Bacterial Bomb

Before daybreak on February 28th, 1952, an American plane flew low over Kam-Heung Li, Won-Pook Myon, Kum-Wha Goon, Kang-Won Do. It strafed and dropped one bomb, which exploded with a weak detonation. Early in the morning Choi Bong-Choon found many flies and mosquitoes on the snow around an "exploded" 4-chamber bacterial bomb, covering an

area of about 100 x 100 yards. It was windy and cold. The mean temperature, according to the daily weather report, was 3°C below zero.

Witness: Choi Bong-Choon.
Specimen Collector: Pak Hai-So.

No. 210

4-Chamber Bacterial Bomb

On March 1st, 1952, an American plane flew low over Wol-Pong Li, Shin-Chun Goon, Huang-He Do. Huang Hae-Meung heard a whistling sound followed by a faintly audible weak detonation. He found and "exploded" 4-chamber bacterial bomb at the foot of the mountain. Around the casing there were numerous flies scattering over an area of about 300 square yards. Some of these flies appeared in clusters and many remained inactive on the ground. It was very cold. The mean temperature, according to the daily weather report, was 1°C below zero.

Witness: Huang Hae-Meung.
Specimen Collector: Kim Pil-Kun.

No. 211

4-Chamber Bacterial Bomb

Before daybreak on March 2nd, 1952, an American plane circled over Paek-Wha Myon, An-Byun Goon, Kang-Won Do without strafing. Kim Do-Yong heard the sound of a falling bomb and a weak detonation. Early in the morning he found an "exploded" 4-chamber bacterial bomb and around it numerous flies in clusters on the snow. These flies remained inactive. The mean temperature, according to the daily weather report, was 2°C below zero.

Witness: Kim Do-Yong.
Specimen Collector: Li Taek-Han.

No. 212

4-Chamber Bacterial Bomb

At about 10 p.m. on March 14th, 1952, an American plane circled low over Yeun-Jae Li, Ha-Tan Myon, Tan-Chun Goon, Ham-Kyong-Nam Do, and dropped a bomb, which exploded with a weak detonation. Next morning Kim Je-Bong found numerous flies and also an "exploded" 4-chamber bacterial bomb. The ground was still covered with snow on which the insects remained inactive.

Witness: Kim Jae-Bong.
Specimen collector: Li Chul-Je.

APPENDIX AA

Report on the Occurrence of Respiratory Anthrax and Haemorrhagic Anthrax Meningitis following the Intrusion of U.S. Military Planes over Northeast China

(ISCC/5)

INTRODUCTION

Following the invasions by American airplanes which disseminated insects and other objects (houseflies, anthomyiid flies, wolf spiders, ptinid beetles and feathers) carrying anthrax bacilli, there occurred suddenly and successively in some invaded areas of Northeast China a hitherto rare disease—anthrax infection through the respiratory route. The following report concerns the dissemination of insects and other objects carrying anthrax bacilli by American airplanes, the sudden and successive occurrence of anthrax infection through the respiratory route in Northeast China, and finally, discussion and conclusion.

CHAPTER I

Insects and Other Objects Carrying Anthrax Bacilli Dropped by American Airplanes

(A) *Feathers*

(1) At 11 a.m. March 11, 1952 when more than four hundred inhabitants of Pei-ching Village, Chang Shan (i.e. the 5th) District of Antung Hsien were holding a meeting, village chief Wu Ching-ming and a farmer Chiang Wen-ch'ang first saw three American planes flying from northwest to southeast. Soon afterwards they observed a greyish object dropped from one of the planes, slowly falling toward southeast. Men and women of the whole village were immediately mobilized to search for that object. A large amount of feathers was found at the Lan-shih-shan region, south east of the village. Two days prior to this, the villagers had been engaged in catching insects in the same region for two days without seeing any feathers. The feathers collected were examined by bacteriologists Hsin Chün, Ching Kuan-hua and Chao Cheng-lin and were found to carry anthrax bacilli (Document AA-1).

(2) At 12:52 March 12, 1952, eight American planes invaded K'uan-tien Hsien. One of the planes dropped a cylindrical object—a bacteria bomb. The remnants of this bacteria bomb were found by a school boy, Li Ssu-chien of K'uan-tien Middle School in the afternoon of March 21 in the maize field of Lou-ho-t'ao outside the east gate of K'uan-tien city. Feathers were found in the vicinity of the bomb fragments. (Please refer to App. V.) Bacteriological examinations of the feathers carried out by bacteriologists, Hsieh Shao-wen (Samuel Zia) and Chang Nai-chu, revealed anthrax bacilli.

(B) *Anthomyiid flies and wolf spiders*

Anthomyiid flies and wolf spiders were also found in the vicinity of the remnants of the bacteria bomb in the maize field at Lou-ho-t'ao, outside the east gate of K'uan-tien City. Specimens of the flies and spiders were collected by entomologists, Prof. Liu Ch'ung-lo and Dr. Ma Shih-chün, and were identified by Dr. Chen Sicien H., Director of the Laboratory of Entomology, Academia Sinica, Assistant Professor Lu Pao-ling, Peking College of Agriculture, and Professor Wang Feng-chen of Tientsin Army Medical College.

The flies and spiders were examined by Dr. Hsin Chün, bacteriologist, and were found to carry anthrax bacilli. (It may be also mentioned that anthrax bacilli were also isolated by bacteriologists Hsieh Shao-wen and Chang Nai-chu from anthomyiid flies and wolf spiders disseminated at Tsingtao by American planes.)

(C) *Houseflies*

At 10 p.m. March 14, 1952 American airplanes invaded Ssuping area. In the afternoon of March 17 Wang You-ts'ai, an inhabitant of San-ho Village, First District, Ssuping City noted large numbers of flies at San-tao-lin-tze outside the village. He called together Ch'iu Jung-sheng and Chao Sheng-tien to burn up as many of the flies as they could with hemp stalk. They reported the incident to their group leader Ts'ao Mei-chiu, who mobilized 6 more members to search out and exterminate a great many more. The chief Chao of the Hsiao-hung-tsui-tze police station happened to pass by the spot at that moment and witnessed the above facts. Next day (March 18) at 3 p.m. Liu Chi-an and Hsü Chung-lin, sanitary inspectors of the city, went to the spot. They searched and found large numbers of flies which were duly destroyed by some 40-50 persons mobilized by the District Government.

The flies were identified by the entomologists Prof. Ch'in Yao-ting and Dr. Feng Lan-pin to be houseflies *Musca vicina*. From such flies

anthrax bacilli were isolated by the Epidemic Prevention Station of Ssuping city. This was confirmed by bacteriologists Hsin Chün and Cheng Keng. (Documents AA-2 & AA-3)

(D) *Ptinid beetles*

In the evening of March 20, 1952, Lu Li-tsun, an inhabitant of Pei-chiao-ch'ang Village, Liu-erh-pu District of Liaoyang Hsien heard the noise of airplanes flying over the village. His sister-in-law also heard the noise; she went out of the house to look for, but could not see any plane. According to the Air Observer Corps, two American planes invaded Liaoyang area at 6 p.m. of that day and again at 6:30 p.m. on March 27. At the time when Lu Li-tsun heard the noise of airplanes, Jen Wan-ku, a militiaman of Pei-chiao-ch'ang Village was on his way to the 4th group of inhabitants on patrol duty. He saw about 160 meters away on the southeast a red object of the size of a thermos bottle dropping from the air above the houses of Chang Chia-feng, Wang Wen-ch'ang and Huang Yü-ch'eng. The object exploded when it was about 3-4 meters above the roof of the houses producing a feeble noise and an offensive smell. At the same time Wang Yung-ch'ang, an inhabitant of Ah-lao-ch'iao also saw the red object from a distance of about 700 meters away on the southwest. Wang Hua-ming, a member of Wang Wen-ch'ang's family saw, through the window, the red object falling in front of their gate when he was sitting on his kang (brick bed). He rushed out of his room but the red object had already disappeared. He went back to his room again and lighted the lamp and saw numerous insects on the outer surface of the window pane. On careful inspection numerous insects were found on the ground and on the outer side of the walls of the above mentioned three houses. Action was then taken to catch and burn these insects. Similar insects were found on other houses in the village. Next day the District Government received reports on the discovery of similar insects in neighboring villages and towns. Up to March 28th, these insects were found in 36 villages and towns including the town of Liu-erh-pu. An-shan city which is not far from Liu-erh-pu was also found to have such insects. The area in which these insects were found covered 30 kilometers from east to west and 20 kilometers from north to south. According to the District Government, such "red object" as described above was also seen to have fallen in various places and similar insects were found also in the fields. The weather then was still very cold. The earth froze at night, melting only in the day time. The insects were identified by entomologists Liu Ch'ung-lo and Lu Pao-lin, as *Ptinus fur*. Bacteriological examination by Drs. Hsieh Shao-wen (Samuel Zia) and Chang Nai-chu, proved that these insects carried anthrax bacilli. (Documents AA-4 & AA-5).

(E) *Entomological Identification*

(1) *Housefly* (*Musca vicina* Macquart)

The fly, specimen No. 13033, discovered in San Ho Village of Ssuping on March 17, 1952, has been identified as housefly, *Musca vicina* Macquart, by entomologists Ch'in Yao-ting, Professor of National Medical College, Shenyang, and Feng Lan-pin, Lecturer of the same College.

This species of housefly belongs to Family *Muscidae,* Order *Diptera.* The characteristics of this species are: Four black longitudinal bands on the mesonotum. In the male, width of front about one-fourth to one-third that of the compound eye, the abdomen light orange in color with a central black stripe dorsally. In the female, width of front slightly narrower than the compound eye, and abdominal tergite orange in color, with grayish yellow tomentum. The identification is based on Li and Feng (3), Tokunaga (1) and a series of publications by Patton (11, 12).

This species of housefly is widely distributed. Outside of Asia, it is the commonest species in Hawaii (2). It has been recorded in China (4, 13). Its habits resemble those of the common housefly (*Musca domestica* Linn.), breeding in such media as horse dung and excreta, garbage and decayed organic materials. There may be many generations a year, varying with the climate of the locality. The adult flies invade houses. (see Document AA-2)

(2) *Ptinid beetle* (*Ptinus fur* Linn.) :

The beetle, specimen No. 362-1 (2007), discovered in Pei-chiao-ch'ang Village of Liaoyang on March 20, 1952, has been identified as ptinid beetle, *Ptinus fur* Linn., by Prof. Liu Ch'ung-lo of the Department of Entomology of Peking College of Agriculture, and by Assistant Professor Lu Pao-lin of the same institution. This species of beetle belongs to Family *Ptinidae,* Order *Coleoptera.* Its characteristics are: A pair of moderately yellowish brown subtomentose cushions on the pronotum. Punctures on elytra arranged parallelly in serial rows, also fine brownish setae on the surface. A white hairy marking near the base and apex of each elytron (see Document AA-4).

The identification is based on Reitter (20) and Hinton (18).

Ptinid beetle has a wide distribution. According to Hsin (15) and Kuan (16), it has been recorded in China.

(3) *Anthomyiid fly and wolf spider*

Details are given in the Report on the Calcareous Bacteriological Bomb Dropped by U.S. Military Plane at K'uan-tien. (App. V).

(F) *Bacteriological Examinations*

(1) *Methods*

The methods for the isolation of anthrax bacilli are briefly given here. Details are obtainable in the Documents at the end of this Appendix.

1. For isolation of bacteria from insects: The insect is first washed in sterile normal saline and cultures are then made of the washing fluid. The insect is then ground up in a sterile mortar with sterile saline. The suspension of the ground insect is cultured and inoculated into white mice. The media used are plain agar plate, blood agar plate, S.S. agar plate and cooked meat broth.

2. For examination of feathers: The feather is washed in sterile normal saline. This saline is then centrifuged at 3000 revolutions per minute for 20 minutes. The sediment is used for culture and animal inoculation as mentioned above.

3. For the examination of human post-mortern material: The material is divided into 2 parts, 1 part is used for direct culture and the other part for animal inoculation.

When organisms are first isolated from any material, further steps are taken for identification. *Bacillus anthracis* is preliminarily diagnosed if the morphology and staining quality of the organisms, appearance of colonies, manner of growth in the broth, the presence or absence of motility and pathogenicity for white mice are identical with those of that organism. Further steps include the test on other laboratory animals for pathogenicity, biochemical characteristics and immunological studies. When all the findings are identical with those of the anthrax bacillus, the isolated organism is finally identified as *Bacillus anthracis*.

(2) *Diagnostic Criteria*

1. Preliminary identification:

a) The colonies are greyish and non-hemolytic slightly elevated with curled-hair appearance at the periphery; their surfaces are rough.

b) Morphology. Gram-positive large bacilli with square ends, non-motile an dlined up in long chains. There are centrally placed spores.

c) Growth in broth, flocculated sediment. No turbidity. No pellicle.

d) Pathogenic to white mice and from the viscera of the dead mice Gram positive, encapsulated large bacilli with square ends are found.

2. Confirmatory tests:

a) Pathogenic for guinea pigs, encapsulated, large Gram positive bacilli with square ends are found in the viscera of the dead animal.

TABLE I. RESULTS OF BACTERIOLOGICAL EXAMINATION

Specimens		Serial No.	355	48004B	48003	17006	362-1	13033
		Name	Feathers	Wolf Spiders	Anthomyiid flies	Feathers	Ptinid beetles	House flies
		Districts	K'uan Tien	K'uan Tien	K'uan Tien	Antung Pei-ching village	Liao-yang	Ssuping
		Date received	April 14	March 24	March 24	March 15	April 14	March 30
General characteristics		Colonies on agar plate	Grayish white in color, not transparent. Edge uneven and curled hair like.					
		Morphology	Gram positive large bacilli with square ends and in chain form, spore formation at centre.					
		Growth in meat broth	Flocculent precipitation					
		Motility	—	—	—	—	—	—
Biochemical Properties		Milk Coagulation Test	+	+	+	+	+	+
		H_2S	—	—	—	—	—	—
		Indol	—	—	—	—	—	—
	Hemolysis	Goat's red blood cells	—	—	—	—	—	—
		Rabbit's red blood cells	—	—	—	—	—	—
		Guinea pig's red blood cells	—	—	—	—	—	—
		Lactose	—	—	—	—	—	—
		Glucose	+	+	+	+	+	+
		Maltose	+	+	+	+	+	+
		Mannitol	—	—	—	—	—	—
		Sucrose	+	+	+	+	+	+
		Inositol	—	—	—	—	—	—
		Xylose	—	—	—	—	—	—
		Arabinose	—	—	—	—	—	—
		Dulcitol	—	—	—	—	—	—
		Salicin	—	—	—	—	—	—
Animal Inoculation	White Mice	Death of animal	Died	Died	Died	Died	Died	Died
	Guinea pigs	Death of animal	Died	Died	Died	Died	Died	Died
		Gelatinous change at site of injection	+	+	+	+	+	+
		Enlargement of spleen	+	+	+	+	+	+
		Congestion and enlargement of liver	+	+	+	+	+	+
		Congestion of lungs	+	+	+	+	+	+
		Cultures of heart blood	+	+	+	+	+	+
		Smear from internal organs	+	+	+	+	+	+
		Precipitation Test	+	+	+	+	+	+

TABLE II. RESULTS OF BACTERIOLOGICAL EXAMINATIONS

			I	II	IIIa	IV
Autopsy Cases		Case No.	I	II	IIIa	IV
		Name	Chü Chan-yun	Wang Tze-pin	Wei-Liu-shih	Tien Cheng-ho
		District	Manching	Shenyang	An-shan	An-tung
		Occupations	Railway worker	Pedicab driver	House wife	Farmer
		Date of onset of disease	March 19	March 20	April 11	April 16
		Date of death	March 22	March 25	April 14	April 18
		Pathological diagnosis	Anthrax of respiratory system	Anthrax of respiratory system and Anthrax Meningitis	Anthrax of respiratory system and Anthrax Meningitis	Anthrax of respiratory system and Anthrax Meningitis
General Characteristics		Colonies on agar plate	Grayish white colonies. Not transparent. Edge uneven and curled hair like.			
		Morphology	Gram positive large bacilli with square ends and in chain form. Spore formation at center			
		Growth in meat broth	Flocculent precipitation			
		Motility	Non motile			
Biochemical Properties		Milk Coagulation test	+	+	+	+
		H_2S	—	—	—	—
		Indol	—	—	—	—
	Hemolysis	Goat's red blood cells	—	—	—	—
		Rabbit's red blood cells	—	—	—	—
		Guinea pig's red blood cells	—	—	—	—
		Lactose	—	—	—	—
		Glucose	+	+	+	+
		Maltose	+	+	+	+
		Mannitol	—	—	—	—
		Sucrose	+	+	+	+
		Inositol	—	—	—	—
		Xylose	—	—	—	—
		Arabinose	—	—	—	—
		Dulcitol	—	—	—	—
		Salicin	—	—	—	—
Animal Inoculation	White Mice	Death of animal	Died	Died	Died	Died
	Guinea pigs	Death of animal	Died	Died	Died	Died
		Gelatinous change at site of injection	+	+	+	+
		Enlargement of spleen	+	+	+	+
		Congestion and enlargement of liver	+	+	+	+
		Congestion of lung	+	+	+	+
		Culture of heart blood	+	+	+	+
		Smear from internal organs	+	+	+	+
		Precipitation Test	+	+	+	+

b) There is fermentation of glucose, sucrose and maltose. Acid is produced without gas. Milk is coagulated.

c) No hemolysis on the red blood cells of goat, rabbit and guinea pig.

d) The liver or spleen of animals died from anthrax is ground up with saline and then boiled and used for precipitation with the filtrate as an antigen, a precipitation test (Ascoli test) is made with anti-anthrax diagnostic serum. The result is positive.

(3) *Results of Examination*

The characteristics of strains of organisms isolated are given in Tables I and II.

CHAPTER II

Sudden and Successive Occurrence of Anthrax Infection through the Respiratory Route

Case 1.

Chü Chan-yun, male, 55 years old, a railway foreman at the Man Ching Station and railwaymen Li Tso-hsiang and Liu Chung-ko on March 16, 1952 took part in catching and killing flies at a place one and one half kilometers to the north of the Man Ching Station. (In the night of March 14 American airplanes invaded Ssuping area including Man Ching Station.)

On March 19, Chü Chan-yun became ill with fever, headache and aching in the limbs. On March 21 he was admitted to the Railway Hospital when he also developed cough, nausea, vomiting and insomnia, mental confusion and rigidity of neck.

Examination of sputum revealed the presence of Gram positive encapsulated large bacilli. White blood cell count 28,000. Death occurred at 2:45 p.m. March 22, 1952.

Autopsy was done by Dr. Sung Teh-yu of the Epidemic Prevention Station of Ssuping. There were congestion, oedema and small hemorrhages in both lungs. Increased consistency was felt in the upper lobe of both lungs. Hilum lymph glands were enlarged. Bilateral pleural effusion and pericardial effusion were present. Ulcerative hemorrhagic spots were seen on the mucosa of small intestine. The tip of the appendix showed hemorrhagic inflammatory process. The mesenteric lymph glands were however not enlarged. Bacteriological examination was done in the Epidemic Prevention Station of Liao-hsi Province. Anthrax bacilli were isolated from the lung, liver and spleen. The organisms were re-examined by bacteriologists Hsin Chun and Cheng Keng and the original diagnosis

of *Bacillus Anthracis* was confirmed. The pathological diagnosis of respiratory anthrax was confirmed by pathologists Professors Wu Tsai-tung and Li Pei-lin.

(The clinical symptoms indicate that the meninges were involved but the skull was not opened for examination at autopsy because of the refusal of the family.) (Document AA-7 and Document AA-10)

Case 2.

Wang Tze-pin, male of 47 years was a tricycle-rickshaw driver in Shenyang. He became ill on March 20 with general malaise. Next day he was confined to bed. On April 22 aching in legs, general weakness, upper abdominal discomfort, nausea and headache were felt. He was slightly better in the morning of April 23 but got worse by the afternoon. Until 6 a.m. April 24 he was still conscious and could move about. However since then he sank progressively into coma with restlessness. Neck was rigid. Kernig's sign was positive. Death occurred at 9 a.m. April 25. Autopsy was done by Prof. Chu Feng-ch'un and assistant Wang Hung-lieh of the National Medical College with the diagnoses of hemorrhagic anthrax meningitis, anthrax bronchopneumonia of right lower lobe, peribronchitis, interlobular cellulitis, suppurative hemorrhagic anthrax lymphadenitis of hilum glands, pulmonary oedema, pleural effusion, pericardial effusion and multiple punctate necrosis and ulceration of intestinal mucosa due to anthrax infection. (No enlargement of mesenteric lymph glands.) The pathological diagnosis was confirmed by Professors Wu Tsai-tung and Li Pei-lin. Anthrax bacilli were isolated from the brain tissue, heart blood and spleen by bacteriologists Chu Chi-ming and Liu Shih-ming and confirmed by bacteriologists Hsin Chun and Cheng Keng. (Document AA-9 and Document AA-10)

Case 3a.

Wei Liu-shih, female of 32 years, was an inhabitant of Anshan City. She was repeatedly engaged in catching and killing insects (*Ptinus fur*) dropped by American airplanes. In the evening of April 11 she felt general malaise. Next day headache, chilliness and fever were noticed. Condition became worse on April 13 and she was confined to bed. Cough, chest pain, shortness of breath and vomiting developed. On April 14 mentality became confused with delirium, restlessness and dyspnea. She had attacks of convulsion. The neck was markedly rigid. Kernig's sign was positive. Dry and moist rales were heard all over the lungs. Death occurred at 11:50 p.m. April 14. Post mortem examination was done by Drs. Chiang Ying-kai and Kuo Cheng-teh, assistants in the department of Pathology of the National Medical College. The pathological diagnoses

were: Hemorrhagic anthrax meningitis, necrotic anthrax pneumonia of left lower lobe, hemorrhagic anthrax lymphadenitis of the hilum, oedema of lungs, bilateral pleural effusion, pericardial effusion and acute splenic tumor. The pathological diagnoses were confirmed by Professors Wu Tsai-tung and Li Pei-lin. Anthrax bacilli were isolated from the brain tissue by bacteriologists, Chu Chi-ming and Liu Shih-ming and confirmed by bacteriologists Hsin Chun and Cheng Keng (Document AA-8 and Document AA-10)

Case 3b

Wang Shu-chih, female of 23 years, was a primary school teacher at Liu-erh-pu of Liao-yang Hsien. She was healthy in the past, and was very actively engaged in catching and killing insects dropped by American airplanes. On April 6 she felt dryness of throat with hoarseness of voice. Some headache and general joint aching was also felt. She was however working as usual until 9 a.m. April 8, when she went to toilet and collapsed there. When picked up by her colleagues from the toilet she was unconscious. Cyanosis was noted and the light reflex of pupils was lost. Death occurred at 10:30 a.m. on the same day. Autopsy was done by Drs. Chao Wen-tou and Wang Hung-lieh of the National Medical College. There were diffuse subarachnoid hemorrhages in the brain and spinal cord. Lungs showed congestion and oedema with bronchopneumonia in the right upper lobe. Cerebral arteries and endocardium were normal. On microscopic examination of sections, Gram-positive bacilli with square ends morphologically identical with anthrax bacilli in the bronchopneumonic lesions, hepatic sinuses, capillaries of the brain, and large vessels of the meninges were seen. Culture was however not done because the autopsy was made at Liu-erh-pu where facilities for bacteriological examination were not available. The pathological material was examined by pathologists Wu Tsai-tung and Li Pei-lin and the diagnoses of acute hemorrhagic anthrax meningitis, anthrax bronchopneumonia of right upper lobe and pulmonary oedema were made. (Document AA-10)

Case 4

Tien Cheng-ho, male, 44 years old, was a farmer of Eastern Shuang Shan Village, Chang Shan district of Antung Hsien. The village is 1¾ kilometers away from Pei Ching Village to the northeast. On April 14, farmer Tien and his son discovered the feathers disseminated by American airplanes and took part in their collection and disposal. He fell ill on April 16 with sudden onset of chills, fever, generalized joint pain and mild headache. Condition became worse the next day. He vomited twice. After daybreak on April 18 he became unconscious with both hands tightly

clenched as in spasm. Temperature was 38.7°C. Death occurred at noon of the same day.

Autopsy was done by Dr. Sung Wei-yi, superintendant of the Liaotung Provincial Hospital. Diffuse hemorrhages were found in the leptomeninges. Internal organs showed marked post-mortem changes. Right lung weighed 850 gms. and left lung 700 gms. The cut surface was purple-black in color with hemorrhages. The hilum glands were as big as the thumb. Direct smears made from the brain, lungs, spleen and kidneys showed numerous Gram positive bacilli with square ends. From cultures and animal inoculations of heart blood, brain, lung, spleen and kidney anthrax bacilli were isolated. The diagnosis of hemorrhagic anthrax meningitis was confirmed by pathologists Professors Wu Tsai-tung and Li Pei-lin. The primary infection was in the lung. The organism, isolated from the heart blood, was confirmed by bacteriologists Drs. Hsin Chun and Cheng Keng to be *Bacillus Anthracis* (Document AA-6 and Document AA-10).

CHAPTER III

Discussion

(A) *Entomological Consideration*

I. *Housefly*:

In North China, under normal conditions, this species of house fly passes winter mainly as pupae, and the adults appear comparatively late in the year. Meng and Winfield (4, 5, 7, 9, 10) have studied this species of flies. According to their report (6), this fly appears in Tsinan, Shantung, in May. They have collected all the flies in a single house throughout a year. Although upon analysis of the 1831 flies collected, this species was found to be 91.77% of the total population, yet not a single specimen of this fly appeared in the period from January to April.

The regional temperature in Northeast China is lower than that in Tsinan. At Ssuping, the average temperature in March, 1952 was 1.4° C below zero. The appearance of this species of housefly in Ssuping should be later than in Tsinan. However, large numbers of these flies were discovered in the field at Ssuping on March 17th, 1952. This is definitely abnormal.

II. *Ptinid beetle*:

This species of beetle is a pest of stored products. According to the reports of Hsin (15), Li (14), Patton (19) and Cotton (17), under natural conditions, the beetle frequents warehouses, granaries,

flour mills and other factories and storage houses for animal and plant products. It damages stored grains, flours, furs, leathers, etc. It is also a well-known museum pest, destroying especially dried specimens of animals and plants.

This species has one to three generations a year, varying with the temperature. In China, it usually passes the winter as larva, but occasionally a few adults may also survive the cold. It takes three and a half months to complete a generation. The adults are active in the night and retire into hiding during daytime; they also have the habit of feigning death.

When the circumstances under which ptinid beetles were discovered at Liaoyang are compared with their behavior under natural conditions, the following four points are noteworthy:

1. Under natural conditions, ptinid beetles should be found at places such as warehouses, especially those for storing grains, flours, furs and leathers, or any other place for storing such materials. However, at Liaoyang and the other localities these beetles were found not around store-houses, but outside ordinary houses. They were found not only on the ground and walls outside the houses, but also in the fields. This is definitely not a natural phenomenon.

2. All the publications mentioned above have pointed out that ptinid beetles are nocturnal. However, at Liaoyang, these beetles were discovered in daytime at places where they do not normally appear. This is at variance with the normal habits of these beetles.

3. On May 26th, 1952, Ma Shih-chun, Assistant Research Member of the Laboratory of Entomology, Academia Sinica, and Lu Pao-ling, assistant Professor of the Peking College of Agriculture went to Pei Chiao Chang Village. The purpose of their visit was to investigate from entomological point of view whether at the time of the discovery of these beetles was there any possibility of appearance in large numbers of ptinid beetles under natural conditions at that place. They found that neither was there any storehouse for grains, furs, leathers, or other substances, nor was there stored in the houses of the people any furs, leathers, or large amounts of grains or other materials on which ptinid beetles might develop. They have come to the conclusion that it is impossible for large numbers of ptinid beetles to appear at that place under natural conditions.

4. After a large number of ptinid beetles had been discovered in Pei Chiao Chang Village of Liaoyang on March 20, 1952, Feng Lan-pin, Lecturer of National Medical College and Assistant Li Shao-hua investigated further whether in the neighboring areas of Liao-

yang were ptinid beetles appearing naturally. They searched in the vicinity of Shenyang and Liaoyang such places as granaries where these beetles might appear, but they were unable to find any. This shows that this species of beetle had not appeared at that time under natural conditions. Thus it is concluded that the appearance of large numbers of ptinid beetles at Liaoyang is unusual and moreover, that these beetles could not have migrated or transferred from the neighboring areas.

It is very evident from the four points mentioned above that at that time no ptinid beetles had appeared at places where they could naturally occur, while on the contrary they suddenly occurred in abundance at places such as Pei-chiao-chang Village of Liaoyang where natural conditions did not permit their appearance. Therefore, from the entomological point of view, the occurrence of ptinid beetles at Liaoyang and Anshan is entirely unusual.

Finally, it is observed that the unusual occurrence of the house flies and ptinid beetles, as mentioned above, was preceded by the intrusion of U.S. military planes into those places.

(B) *Bacteriological Consideration.*

As mentioned in the literature (21, 23) different strains of anthrax bacilli may show differences in certain biochemical reactions. This is amply confirmed by personal observations of Prof. Cheng Keng in this country, especially in the speed of sucrose and salicin fermentations. But the biological and biochemical features of the 10 strains of anthrax bacilli isolated from feathers, insects and human autopsy material are entirely identical. This speaks for the common origin of all the organisms isolated from *Ptinus fur*, housefly, feathers and the clinical cases of anthrax infection.

In 1894 Heim (25) reported the finding of pathogenic anthrax spores on the body surface and in the excreta of *Ptinus*. Cao (22) experimented with the ova of housefly (*Musca domestica*). The surface of the ova was sterilized. They were then hatched in the flesh of an animal died of anthrax. Anthrax bacilli could be found in the larvae, and, in the adults, for at least 9 days after hatching. As far back as 1869 Raimbert had experimental proof that the fly could carry anthrax bacilli (27). Nuttall (26) mentioned Bollinger as having caught flies from a cow died of anthrax and isolated anthrax bacillus from the digestive tract of the flies. These flies were inoculated into 2 rabbits which later died of anthrax. In 1912 Graham—Smith (24) reported the feeding of

larvae of housefly with foods carrying anthrax bacilli. The organism could be isolated from most of the adult flies.

The above works indicate that the *Ptinus fur* and housefly could be used to carry anthrax bacilli.

Some control observations have been made in our laboratory (See Appendices E and F). In June 1952, 3106 flies of various kinds were collected from Shen-yang including *Fannia scalaris, Muscina stabulans, Lucilia sericata, Sarcophaga* sp., *Calliphora* sp. etc. From such a large number of flies no anthrax bacilli were isolated. At the same time 13 specimens of feathers from Shen-yang and 3 specimens from Kuantien were examined. No anthrax bacilli were found in these local specimens of feathers. No control studies have been made for *Ptinus fur* since it was impossible to find a local specimen. The control observations would further indicate that the isolation of anthrax bacilli from insects, (*Ptinus fur* from Liaoyang, housefly from Ssuping, anthomyiid fly from Kuantien) wolf spiders (from Kuantien) and feathers (from Kuantien and Pei-ching Village of Antung) is not merely an accident.

That *B. anthracis* could be used as a bacteriological weapon is well known. Rosebury and Kabat (28) put it on the top of the list of organisms for air-borne infection because: "The anthrax bacillus is one of the most thoroughly studied bacteria. Its properties make it an obvious possibility as an agent in warfare." "*B. anthracis* is surpassed by few micro-organisms in infectivity for animals, and by none in host range." Zelle *et al* (29-32) in Camp Detrick carried out extensive studies on *B. anthracis* as a bacteriological weapon. They reported on the selection of strains, nutrition studies and the use of chemicals to enhance the invasiveness of the organism. Some variants were obtained especially suitable for infection through the respiratory route. The virulence of the organism could be artificially increased for the purpose of bacterial warfare.

From the facts mentioned above it is not difficult to unravel the plot of American government of disseminating *B. anthracis* in order to wage bacteriological warfare in Northeast China.

(C) *Pathological Consideration*

In the 5 cases of anthrax infection the etiological diagnosis was established either by culture or by the demonstration of the organisms in pathological sections. Clinically there were manifestations of respiratory infection in every case. Case 1 had congestion and oedema of both lungs with increase of consistency in upper lobes, enlargement of hilum glands and bilateral pleural effusion etc., lesions en-

tirely similar to those of case 2 and case 3a. Case 3b had anthrax bacillus bronchopneumonia though the bronchial lymph glands were not enlarged. In case 4 the lungs were evidently increased in weight and the bronchial lymph glands were enlarged. All 5 cases had lesions in the respiratory system. There was no cutaneous lesions in any one of these. Although hemorrhagic ulcers were found in intestines in case 1 and case 2 but the mesenteric glands were not enlarged so the intestinal lesions could not be primary in nature. They were probably produced after the swallowing of bacteria in the sputum or secondary to septicaemia (34) shortly before death. So we conclude that all the 5 cases were anthrax infection through the respiratory route (36). 4 of the 5 cases had proven lesions of hemorrhagic anthrax meningitis. The extensive diffuse subarachnoid hemorrhage and the lack of striking cellular reaction were characteristic of anthrax meningitis (33—40). In case 1 the brain was not examined at post-mortem but clinically the patient also had headache, vomiting, coma and nuchal rigidity, pointing to the presence of meningitis. The isolation of anthrax bacilli from heart blood, liver, spleen, lung, brain and other internal organs proves the presence of septicaemia. The death was evidently due to a combination of hemorrhagic meningitis and septicaemia.

Anthrax is primarily a disease of herbivorous animals. The susceptibility of man to *B. anthracis* is comparatively low. So anthrax infection is rare in human beings (33, 37, 39, 41). The mode of infection in the human disease is principally contact with diseased or dead animals or their hides and excreta harboring anthrax bacilli. The usual form of anthrax in man is cutaneous infection. Infection through the respiratory route is extremely rare (35). Under natural conditions respiratory infection of anthrax is also related to animal hides and wool, so it is called wool sorters disease. In the 5 cases mentioned in this report no history of contact with such things could be elicited.

Anthrax meningitis is a very rare disease. Lin and Chen (38) saw 2 cases from 1937 to 1946. They searched the world's literature from 1927 to 1940 and came across only 11 papers, mostly of single case reports. Most of the cases in the literature started as cutaneous infection and the meninges were secondarily infected. Since 1940 such reports became even scantier in the literature. In 1947 Shanahan *et al* (42) reported 1 case, a rug worker who had anthrax meningitis following a malignant pustule of the upper lip.

In China post-mortem and clinical statistics from medical colleges and their teaching hospitals likewise indicate the rarity of

anthrax meningitis. The Shanghai Medical College had 1178 autopsies from 1928 to 1952. The China Union Medical College performed 3942 autopsies from 1916 to 1952. In the National Medical College at Shenyang 1093 post-mortem examinations were done from 1940 to 1952. Not a single case of anthrax meningitis was found among the total member of 6213 autopsies in the above mentioned three institutions. Professor Wu Tsai-tung saw only 1 case of anthrax meningitis in 21 years of his career as a pathologist and the patient he saw had definite contact with hides before the onset of the disease. Therefore there is no doubt that this disease is very rare in this country and abroad.

In Man Ching, Shenyang, Liaoyang, Anshan and Eastern Shuang-shan Village, Chang-shan district of Antung Hsien anthrax of skin was rare in the past. Anthrax infection through the respiratory route and anthrax meningitis had never been observed. In the teaching hospitals of National Medical College, Shenyang from 1949 to June 1952 only 1 case of skin anthrax was seen among 1,400,000 out-patients. It means that anthrax is very rare in Shen-yang area. In the Liu-erh-pu district including the town of Liu-erh-pu and 35 villages, with a total population of 61,372 persons in 14,029 families no case of anthrax has ever been discovered in the past 10 years. In Anshan City, from Jan. 1950 to March 1951, among the 760,212 patients of all the public and private hospitals and clinics, not a single case of anthrax was observed.

Anthrax was rare not only in man but also in animals. In Shenyang only 6 cases of animal anthrax were recorded in the past 5 years but has not been seen in the past 3 years. According to the records of the Veterinary Hospital and the personal records of the veterinarians at Liu-erh-pu anthrax has not occurred among 4646 domestic animals under their care in the whole district in the past 10 years. A similar result was obtained on investigation into the animal diseases in Anshan. In the recent years, there was also no anthrax among domestic animals in Man Ching station and Eastern Shuang Shan village. This is not just an accidental occurrence, it is the result of widespread use of prophylactic vaccinations.

Conclusion

(1) Anthrax was a rare disease in man and animals in Man-Ching, Liaoyang, Anshan, Shen-yang and Antung Hsien in the past. But from March 19 to April 16, 1952, within a short period of less than one month, cases of anthrax infection through the respiratory route occurred in succession. This is an extremely unusual phenomenon.

(2) *B. anthracis* was isolated from insects and other objects disseminated by American airplanes. The same organism was obtained from brain and other internal organs of persons dead from anthrax infection. The biological and biochemical properties of *B. anthracis* from insects and pathological materials were entirely identical.

(3) All the 5 cases of human anthrax infection had manifestations and lesions of the respiratory system indicating that the infection was introduced through the respiratory route and produced fatal results through septicaemia and hemorrhagic meningitis.

(4) Summing up the facts mentioned above, we conclude that the human anthrax infection was produced by the bacteriological warfare of the American government.

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Pathology	33-42

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DOCUMENT AA-1

REPORT ON BACTERIOLOGICAL EXAMINATION OF FEATHERS

1. Specimen No.: 17006.
2. Source of specimen: sent from Peiching Village, Antung City.
3. Date received: March 15th, 1952.
4. Kind of specimen: Feathers.
5. Procedures: The feather was put in a mortar, washed and ground with sterile physiologic saline. The washing fluid was injected intraperitoneally into 2 mice, each receiving 0.5 ml., and was cultured on plain agar plate and blood agar plate for bacterial isolation. Smears were also made for microscopic examination.

(1) Under microscope, no bacteria were seen on the smears.

(2) The cultures made from the above-mentioned washing fluid on agar plate and blood agar plate resulted in growth of grayish white, irregularly edged and rough-surfaced colonies. Stained smears revealed large-sized bacilli with square ends, lined up in chains. There were centrally placed spores in the bacteria. Gram positive. No motility. Pure cultures were made from this kind of colony.

(3) 0.5 ml. of the above-mentioned washing fluid was inoculated into the peritoneal cavity of two mice. One of the mice died after 24 hours and the other died 36 hours afterwards. The spleen smear was stained and examined under microscope. There were found encapsulated large Gram positive bacilli with square ends. Cultures yielded the same kind of bacteria.

(4) Examination of the pure cultures.

I. Morphology:

(1) Cultured on plain agar plate and meat broth, the bacteria are large bacilli with square ends, lined up in chains, with centrally placed spores. No motility. Gram positive.

(2) Direct smears made from heart blood, liver and spleen of the dead mice and guinea pigs inoculated with this bacteria showed Gram positive encapsulated large bacilli.

II. Cultural characteristics:

(1) Plain broth: Growth with flocculent sediments, broth not turbid.

(2) Plain agar plate: Grayish white colcred opaque colonies with irregular edges and rough surfaces. Under hand lens the periphery of the colony was curly-hair in appearance.

(3) Gelatin: Stab culture grew like an inverted fir tree. Very slow liquefaction of the gelatin.

(4) Blood agar: No hemolysis.

(5) Milk: Coagulated.

III. Biochemical characteristics: It fermented glucose, maltose and sucrose without gas formation, but did not ferment lactose, mannitol, dulcitol, inositol, xylose, arabinose and salicin. Hydrogen sulfide negative. Indol reaction negative.

IV. Hemolysis test: 2% suspensions of red blood cells in normal saline were prepared respectively with blood from rabbit, guinea pig and goat. Bacteria suspension (1 loopful in 1 ml.) was mixed with the red cell suspension and kept in an incubator for 2 hours and control test was done with *B. subtilis*. The results are shown in the following table:

Bacterial suspension / 2% R.B.C. suspension	Suspension of bacteria isolated	*B. subtilis* (control)
Rabbit	No hemolysis	Hemolysis
Guinea pig	No hemolysis	Hemolysis
Goat	No hemolysis	Hemolysis

V. Pathogenicity test:

(1) Mouse: Died in one day after subcutaneous injection of ¼ loopful of the bacteria, and in three days after injection of 1/100 loopful. Smears of liver, spleen and heart blood showed the presence of encapsulated Gram positive large bacilli with square ends.

(2) Guinea pig: Died in two days after subcutaneous injection of 1/4 loopful of the bacteria. Autopsy findings: gelatinous exudate at the site of injection. Spenic enlargement. Smears of liver, spleen and heart blood showed the presence of Gram positive encapsulated large bacilli with

square ends. General and biochemical characteristics of the bacilli isolated from these organs were identical with those isolated directly from the feathers.

VI. Immunological characteristics:

Ascoli test. The liver and spleen of mice and guinea pigs died after inoculation were ground separately, and their respective suspensions were made. These suspensions were immediately boiled for 30 minutes in water bath and filtered through filter paper. Precipitation reactions were carried out with these filtrates and diagnostic anti-anthrax serum. Control matreals included the liver and spleen of healthy mice and guinea pigs and also normal rabbit serum. The results are as follows:

Antigen / Serum	Boiled Antigen		Boiled filtrates of visceral organs of healthy animals		Saline
	Mice	Guinea pigs	Mice	Guinea pigs	
Diagnostic anti-anthrax serum	(+)	(+)	(—)	(—)	(—)
Normal rabbit serum	(—)	(—)	(—)	(—)	(—)

Conclusion: *Bacillus anthracis* isolated from the specimen of feathers.

Examined by:

Ching Kuan-hua, M. B.

Assistant Prof. of Bacteriology, National Medical College, Shenyang.

Chao Cheng-lin, M. B.

Assistant Prof. of Micrology, Harbin Medical College.

Reexamined and Reported by:

Hsin Chün, M. D.

Chief Technical Expert of Northeast Epidemic Prevention Institute.

Date of Report: April 25, 1952.

DOCUMENT AA-2

REPORT ON ENTOMOLOGICAL IDENTIFICATION OF HOUSEFLIES

Serial No. of specimen: 13,033	Original No. of specimen:	Date received: March 22, 1952

Circumstances of discovery:

At 10 p.m., March 14, 1952, American military planes invaded the area of Ssuping municipality. On March 17, inhabitants of San Ho Village, Ssuping municipality found large quantities of flies at San Tao Lin Tze, outside the village.

Results of identification:

Scientific name: *Musca vicina* Macquart (**Diptera, Muscidae**)

Common name: Housefly.

Comments: Houseflies usually inhabit the vicinity of houses and animal enclosures. In the Northeast they do not appear outdoors until May. Their sudden discovery in the cold weather of March in open fields must be attributed to the activities of American aircraft.

Remarks:

Identified by:

Ch'in Yao-ting, Professor of Biology, National Medical College, Shenyang.

Feng Lan-pin, M.B., Lecturer, Department of Medicine, National Medical College, Shenyang.

Date: March 24, 1952

DOCUMENT AA-3

REPORT ON BACTERIOLOGICAL EXAMINATION OF HOUSEFLIES

Date of receiving specimen: March 18, 1952, at 5 p.m.
Kinds of specimen: Houseflies.
Source of specimen: Ssu-ping City.
Procedure and Results:

20 flies, crushed with a pair of sterile forceps were used for the following bacteriological tests.

1. Direct smear: Large Gram-positive spore-bearing bacilli with square ends were seen.

2. Culture on agar plate: After incubation for 18 hours, there was a growth of grayish white colonies with rough surfaces and irregular edges. When examined with a hand-lens, the edge was in the form of curled hair appearance. These colonies were taken for further examinations as follows:

A. Direct smear examination showed Gram positive bacilli with square ends and arranged in long chains. Hanging drop examination showed no motility.

B. Culture in meat broth: After incubation for 18 hours, there was flocculent sedimentation at the bottom of the tubes. The supernatant liquid was clear. Microscopic examination of the direct smear revealed also Gram positive bacilli in long chains. Hanging drop examination showed no motility.

C. Culture in peptone water revealed the same findings as in broth. No indol formation.

D. Intraperitoneal inoculation with the suspension of the pure culture into 3 white mice and 3 guinea pigs 0.2 ml. of the bacteria suspension was used for each mouse and 0.5 ml. for each guinea pig. They died one after another from 26 to 42 hours. On autopsy, smears made from the spleen revealed the same kind of large Gram-positive bacilli.

E. Cultures of the heart blood of these dead animals yielded pure growth of the same bacteria.

Preliminary Diagnosis: *Bacillus anthracis* isolated from the houseflies.

Examined by Chang Yü-chia
Ssu-ping Health Station

Date of report: **March 23, 1952.**

REPORT ON BACTERIOLOGICAL IDENTIFICATION

1. No. of specimen: 13033
2. Source of specimen: A strain of bacteria isolated from the house-flies at Ssu-ping, sent by Anti-epidemic Station of Ssu-ping.
3. Date Received: March 30, 1952.
4. Procedures: The following examinations were done after receiving the specimen:

I. Morphology:

Gram-positive large bacilli with square ends and central spore formation. Lined in the form of a chain: Hanging drop examination revealed no motility of the organism.

II. Cultural Characteristics:

1) Plain agar plate: The colonies appeared rough and opaque with uneven edges and curled-hair appearance.

2) Meat broth: Growth with flocculent precipitation. The supernatant fluid clear. No pellicle formation.

3) Blood agar plate: The appearance of colonies was the same as on the plain agar plate. No hemolysis.

4) Gelatin media: Stab culture showed inverted fir tree-like growth in 24 hours, while liquefaction took place gradually several days later.

5) Milk media: Coagulated

III. Biochemical Characteristics: A pure culture of this strain was used for the following biochemical examinations. The results were:

Indol reaction	(—)	Mannitol	(—)
Lactose	(—)	Xylose	(—)
Glucose	(+)	Inositol	(—)
Maltose	(+)	Arabinose	(—)
Sucrose	(+)	Salicin	(—)
Dulcitol	(—)	Hydrogen sulfide	(—)

IV. Hemolytic Reaction:

Three 2% saline suspensions were made respectively with the red blood cells of goat, guinea pig and rabbit. Each of these suspensions was then mixed with the bacterial suspension (1 loopful/ml.). They were incubated for 2 hours and examined for hemolysis. Control examinations were made with *Bacillus subtilis*. The results were as follows:

Bacterial suspension / 2% R.B.C. suspension	Present specimen	*B. subtilis*
Rabbit	no hemolysis	hemolysis
Guinea pig	no hemolysis	hemolysis
Goat	no hemolysis	hemolysis

V. Pathogenicity Tests: A saline suspension was made with the present specimen of bacteria (2 loopful/ml.) Into each of the two white mice, 0.2 c.c. of the suspension was injected intraperitoneally, and into each of the two guinea pigs, 0.5 c.c. were injected subcutaneously. Mice died in 30 hours and guinea pigs died in 3 days. Autopsy on these dead animals revealed enlargement of both liver and spleen. From smears of the heart blood, spleen and liver, Gram positive square ended large bacilli with capsule formation were observed. On culture, same kind of organism was obtained.

VI. Serological examinations: A piece of liver and spleen of the dead guinea-pig was each ground separately and diluted with saline. After boiling for 30 minutes, Ascoli precipitation test was carried out with the filtrate. The filtrates of the liver and spleen of a healthy guinea-pig were used as controls.

Antigen / Sera	Boiled antigens		Boiled organs of healthy animals		Saline
	Liver	Spleen	Liver	Spleen	
Anti-anthrax diagnostic serum for Ascoli test	+	+	—	—	—
Normal rabbit serum	—	—	—	—	—

Conclusion: *Bacillus anthracis* confirmed.

Examined by Hsin Chün M.D.
Chao Lin M.B.

Reported by Hsin Chün M.D.,
Chief Technical Expert of Northeast
Epidemic Prevention Institute.

Date of report: April 15, 1952.

DOCUMENT AA-4

REPORT ON ENTOMOLOGICAL IDENTIFICATION OF PTINUS FUR

Serial No. of specimen: Chien-362-1	Original No. of specimen: Fang-023	Date received: April 6th, 1952

Circumstances of discovery:

Discovered on March 20, 1952, at Liaoyang. Prior to the discovery, the inhabitants of the place had seen a reddish object dropped from the air. Large numbers of insects of this species were discovered immediately afterwards outside houses on the walls and in the fields.

Results of identification:

Scientific name: *Ptinus fur* Linn. **(Coleptera, Ptinidae)**

Common name: Ptinid beetle

Comment: Ptinid beetle is a pest of warehouses. Under natural conditions, they are found mostly in storehouses, granaries, flour mills, or other places for manufacturing or storing animal or plant products. In the present instance, large numbers were suddenly discovered outside houses on the walls, in the fields. This is evidently unusual

Remarks

Identified by:

Liu Chung-lo, B.A., Ph.D., Director of the Entomological Research Institute, Peking College of Agriculture.

Lu Pao-lin, M.S., Assistant Professor of Department of Entomology, Peking College of Agriculture.

Date: April 30, 1952

DOCUMENT AA-5

REPORT ON BACTERIOLOGICAL EXAMINATION OF PTINUS FUR

Serial No.: 362-1

Date received: April 14, 1952.

Kind of specimen: 6 ptinid beetles (*Ptinus fur*)

Source of specimen: Liaoyang

Method of examination: Six ptinid beetles were washed in 5 cc sterile physiological saline. The washing fluid was inoculated on plain agar plate, blood agar plate, S.S. agar plate and cooked meat broth. The beetles were then ground in a sterile mortar with 5 cc of a mixture of serum and meat broth and the suspension was plated on different media as before.

Results of examination: These plates were incubated for 24 hours. On the plain and blood agar plates, 2 kinds of colonies were observed. One was rough surfaced, elevated and grayish white in colour with an irregular edge. The diameter of each colony was 2-3 mm. Smears made from these colonies revealed Gram positive bacilli, with square ends, and lined up in chains.

The other kind of colonies was round in shape, also elevated and greyish white in colour, but the surface was smooth and the edge regular. Smears revealed Gram negative short bacilli. On the S.S. agar plate, there was growth of colorless and transparent colonies. In the cooked meat broth there was a turbid growth with production of gas. Smears revealed both Gram positive and negative bacilli.

I. Gram positive bacilli

From the blood agar plate the bacteria were transferred to serum broth. Observation made 6 hours later revealed no motility. The bacteria were then again inoculated into the following sugar tubes and special media. The results were as follows:

1. Bouillon tube—growth with flocculent sediments.
2. Milk—coagulated.
3. Methylene blue reduction test—negative.
4. Sugar fermentation reactions: Fermentation took place in the tubes containing glucose, maltose and sucrose with production of acid but no gas. There was no fermentation in the tubes containing lactose, mannitol, dulcitol, inositol, xylose, arabinose and salicin.

5. No production of indol or H_2S.

6. Hemolytic test—no hemolysis.

7. Animal inoculations:

A 24 hours' pure culture on agar slant was washed with 5 cc of sterile physiological saline and 0.5 cc of the suspension was injected subcutaneously into a guinea-pig. The animal died in 24 hours. Autopsy revealed the spleen enlarged to about 3 times of its normal size. At the site of injection there was gelatinous exudate. The smears made from the heart blood and local exudate both showed Gram positive encapsulated bacilli. Culture of the heart blood revealed the same kind of organisms.

Meanwhile the bacterial suspension was diluted to 1: 10 and 1:100, and 0.3 c.c. of each preparation was injected into 3 white mice. They all died within 20-30 hours. On autopsy, the spleen was found enlarged to 4 times of its normal size. On the surface of liver and spleen, there were hemorrhagic spots. Direct smears made from the peritoneal fluid, liver, spleen and the heart blood revealed Gram positive encapsulated bacilli with square ends and cultures revealed the same kind of bacilli as before.

A 24 hours' pure culture on an agar slant was again washed with 3 cc of physiological normal saline and 0.5 cc of the suspension was injected subcutaneously into a sheep. The animal died in 44 hours. Direct smears made from the heart blood, meninges, lungs and spleen all showed Gram-positive bacilli with capsule formation. From the bacterial cultures the same kind of organisms was obtained.

8. Ascoli's Test: Positive

II. Gram negative bacilli

(1) Blood agar plate: very small, grayish, elevated colonies of pin-head size. No hemolysis. Edge regular and surface smooth. China blue plate: Transparent, pinkish, well grown.

(2) Semisolid agar: showing motility.

(3) Indol (—), Citrate (+), Liquid base, turbid, Reduction of nitrate (+), Methyl red (—), No liquefaction of gelatin, V. P. test (—).

(4) Intraperitoneal injection (0.5 cc) into a white mouse—no death in 3 days.

(5) Fermentation Reactions:

Glucose, maltose-Production of acid but no gas. Lactose, sucrose, mannitol, xylose, arabinose, dulcitol, salicin and inositol–no fermentation.

Conclusion:

1. *Bacillus anthracis* isolated from *Ptinus fur.*
2. Gram-negative bacilli, not belonging to the "intestinal group."

Examined by
Wang Chin-tung

Reported by
Hsieh Shao-wen (Samuel Zia), M.D.
Professor of Bacteriology
Chang Nai-chu, M.D.
Assistant Professor of Bacteriology
China Union Medical College.

Date of Report: April 23, 1952.

DOCUMENT AA-6

REPORT ON BACTERIOLOGICAL EXAMINATION OF AUTOPSY MATERIAL FROM TIEN CHENG-HO

1. No. of specimen: 168
2. Source of specimen: Antung
3. Date received: April 19, 1952.
4. Kinds of specimen: Heart blood, spleen, lung, kidney and brain of Tien Cheng-ho.
5. Procedure: After receiving the specimens, smear examination, isolation culture and animal inoculation were immediately carried out. The following results were obtained.

(1) Microscopic examination of the stained smear: From the brain, spleen, lung and kidney, large Gram-positive bacilli with square ends were found.

(2) Isolation culture:

(a) The heart blood, spleen, lung, brain and kidney were streaked separately on plain agar slants. After 24 hours incubation at 37°C, large grayish white colonies with uneven edges and rough surfaces were seen. Microscopic examination of stained smears made from these colonies revealed Gram-positive and spore-bearing large bacilli. The morphology of the bacteria in the colonies from various cultures was identical.

(b) The heart blood, spleen, lung, kidney and brain tissue were inoculated into meat broths for enrichment. Microscopic examination of the stained smear on the next day revealed large Gram-positive bacilli. Isolation of culture was made on plain agar plates and morphologically identical bacilli were obtained from various enrichment media.

(c) The brain tissue was made into a 10% emulsion with normal saline and 0.2 ml. of this emulsion was injected subcutaneously into a white mouse. The mouse died 12 hours later.

At autopsy, hemorrhagic spots were seen on the heart, liver and spleen. Microscopic examination of the stained smears made from these organs revealed encapsulated large bacilli. The same kind of bacilli was obtained from the agar slant used for isolation culture.

(3) Ascoli precipitation test:

A piece each of liver and spleen of the dead white mouse was minced separately with 5 ml. of sterile normal saline. Each of the suspension was boiled for 30 minutes and the supernatant clear fluids were used for Ascoli precipitation test against anthrax diagnostic serum. The results were positive.

(4) Pathogenicity to guinea-pigs. The bacteria isolated from the brain tissue was made into a suspension (a slant of culture was mixed with 10 ml. of saline) and 0.5 ml. of this suspension was injected under the abdominal skin of a guinea pig weighing 750 gms. The guinea pig died 95 hours later.

Autopsy findings and bacteriological culture: Gelatinous and bloody exudate were seen at the site of injection. The heart, liver, spleen and lung were congested with hemorrhagic spots. Microscopic examination of the stained smears made from the above mentioned organs revealed Gram-positive encapsulated large bacilli with square ends.

Isolation cultures made with various organs on the agar plates grew large colonies with curled hair-like edge. Microscopic examination of the stained smears revealed Gram positive large bacilli.

6. Conclusion: From the heart blood, brain, spleen, lung and kidney, *Bacillus anthracis* was isolated.

Examined by Sun Ching-ch'ang, Laboratory of Antung Health Bureau.

Date reported: April 25, 1952.

REPORT ON
BACTERIOLOGICAL IDENTIFICATION

1. No. of Specimen: 38040

2. Source of Specimen: A strain of bacteria isolated from the heart blood of Tien Cheng-ho, sent by Laboratory of Municipal Health Bureau of Antung City.

3. Date Received: May 17, 1952.

4. Procedure: The following examinations were done after receiving the specimen:

I. Morphology:

Gram-positive large bacilli with square ends and central spore formation, lined in the form of a long chain. Hanging drop examination revealed no motility of the organism.

II. Cultural Properties:

1. Plain agar plate: The colonies appeared rough and opaque with edge uneven and curled hair-like.

2. Meat broth: Growth with flocculent precipitation. The supernatant fluid clear. No pellicle formation.

3. Blood agar plate: The appearance of colonies was same as those on the plain agar media. No hemolysis.

4. Gelatin: Stab culture after 24 hours incubation produced inverted fir tree-like growth which liquefied gradually several days later.

5. Milk: Coagulated.

III. Biochemical Properties: A pure culture of this strain was used for the following biochemical examinations:

Indol reaction	(—)	Mannitol	(—)
Lactose	(—)	Xylose	(—)
Glucose	(+)	Inositol	(—)
Maltose	(+)	Arabinose	(—)
Sucrose	(+)	Salicin	(—)
Dulcitol	(—)	Hydrogen sulfide	(—)

IV. Hemolytic Reaction:

Three 2% saline suspensions were made respectively with the red blood cells of goat, guinea pig and rabbit. Each of these suspensions was then mixed with a bacterial suspension (1 loopful/ml.), incubated for 2 hours and they were examined for hemolysis. Control examinations were made with *Bacillus subtilis.* The results were as follows:

Bacterial suspension / 2% R.B.C. suspension	Present specimen	Control test with *B. Subtilis*
Rabbit	no hemolysis	hemolysis
Guinea pig	no hemolysis	hemolysis
Goat	no hemolysis	hemolysis

V. Pathogenicity Tests: A saline suspension was made with the present specimen of bacteria (2 loopfuls/ ml.). Into each of the two white mice, 0.2 ml. of the suspension was injected intraperitoneally, and into each of the two guinea pigs, 0.5 ml. was given subcutaneously. Mice died in 18 hours and guinea pigs died in 48 hours. Autopsy on these dead animals revealed enlargement of both liver and spleen. From smears of the heart blood, spleen and liver, Gram positive square ended large bacilli with capsule formation were isolated. On culturing, similar organisms were obtained.

VI. Serological Examinations. A piece each of liver and spleen of the dead guinea-pig was ground separately and diluted with saline. After boiling for 30 minutes, Ascoli precipitation test was carried out with the supernatant clear fluids. The liver and spleen of a healthy animal were used for control.

Antigen / Serum	Boiled antigen		Boiled viscera of healthy animal		Normal saline
	Liver	Spleen	Liver	Spleen	
Anthrax diagnostic precipitation serum	+	+	—	—	—
Serum of healthy rabbit	—	—	—	—	—

Conclusion: *Bacillus anthracis* Confired.

Examined by Cheng Keng, Sc. D.,
Professor of Bacteriology, Department of Veterinary Medicine, College of Agriculture, National Nanking University.

Reported by Hsin Chün, M.D.,
Chief Technical Expert of Northeast Epidemic Prevention Institute.

Date Reported: June 2, 1952.

DOCUMENT AA-7

REPORT ON BACTERIOLOGICAL EXAMINATION OF AUTOPSY MATERIAL FROM CHU CHAN-YUN

1. Specimen No.: 7.
2. Source of specimen: Ssu-ping City.
3. Date received: March 23, 1952.
4. Kinds of specimen: Spleen, lung and liver of Chü Chan-yün, a small piece of each.
5. Procedure:

(1) Microscopic examination of the direct smears made from the liver, spleen and lung revealed large Gram-positive bacilli with square ends and capsule formation.

(2) Isolation culture:

The liver, spleen and lung were streaked separately on plain agar plates. After incubation at 37°C for 24 hours, there grew large colonies with curled hair-like edges. Microscopic examination of the smears made from these colonies revealed large Gram-positive bacilli with centrally placed spores. They showed no motility ~~in hang-~~ing drop.

(3) Animal inoculation:

The spleen was made into a 1:10 suspension, 0.2 ml. of which was injected into the abdomen of a guinea pig. The guinea pig. died 24 hours later and on autopsy, its liver and spleen were enlarged, with congestion and hemorrhage. Large Gram positive square-ended bacilli were found in these organs under microscope.
were enlarged, with congestion and hemorrhage. Large Gram positive square-ended bacilli were found in these organs under microscope.

(4) Ascoli precipitation test.

A piece of the spleen in the human specimen and a piece each of the liver and spleen of the dead guinea pig were cut with scissors into fragments in physiologic saline. The suspensions were boiled for 20 minutes and the supernatant fluids, after filtration, were tested for precipitation reaction with diagnostic anti-serum for anthrax. The results were all positive.

Conclusion: *Bacillus anthracis* was isolated from the liver, spleen and lung specimens.

Examined by: Chang Yü-chia, Ssu-ping Health Station
Date reported: March 26, 1952.

REPORT ON BACTERIOLOGICAL IDENTIFICATION

1. No. of Specimen: 13042
2. Source of Specimen: A strain of bacteria isolated from the lungs of Chü Chan-yün at Ssu-ping, sent by Health Station of Ssu-ping City.
3. Date Received: May 8, 1952.
4. Procedure: The following examinations were done after receiving the specimen:

I. Morphology:

Gram-positive large bacilli with square ends and central spore formation, lined in the form of a long chain. Hanging drop examination revealed no motility of the organism.

II. Cultural Properties:

1. Plain agar plate. The colonies appeared rough and opaque with edge uneven and curled hair-like.

2. Meat broth: Growth with flocculent precipitation. The supernatant fluid clear. No pellicle formation.

3. Blood agar plate. The appearance of colonies were same as those on the plain agar plate. No hemolysis.

4. Gelatin: Stab culture after 24 hours incubation produced inverted fir tree-like growth which liquefied gradually several days later.

5. Milk: Coagulated.

III. Biochemical Properties: A pure culture of this strain was used for the following biochemical examinations:

Indol reaction	(—)	Mannitol	(—)
Lactose	(—)	Xylose	(—)
Glucose	(+)	Inositol	(—)
Maltose	(+)	Arabinose	(—)
Sucrose	(+)	Salicin	(—)
Dulcitol	(—)	Hydrogen sulfide	(—)

IV. Hemolytic Reaction:

Three 2% saline suspensions were made respectively with the red blood cells from a goat, a guinea pig and a rabbit. Each of these suspensions was then mixed with a bacterial suspension (1 loopful/ml.). They were incubated for 2 hours and examined for hemolysis. Control examinations were made with *Bacillus subtilis*. The results were as follows:

2% R.B.C. suspeusion \ Bacterial suspension	Present specimen	Control test with *B. subtilis*
Rabbit	no hemolysis	hemolysis
Guinea pig	no hemolysis	hemolysis
Goat	no hemolysis	hemolysis

V. Pathogenicity Tests:

A saline suspension was made with the present specimen of bacteria (2 loopfuls/1 ml.). Into each of the two white mice, 0.2 ml. of the suspension was injected intraperitoneally, and into each of the two guinea pigs, 0.5 ml. were given subcutaneously. Mice died in 20 hours and guinea pigs died in 48 hours. Autopsy on these dead animals revealed enlargement of both liver and spleen. From smears of the heart blood, spleen and liver, Gram positive square ended large bacilli with capsule formation were observed. On culture, same kind of organisms was obtained.

VI. Serological Examinations: A piece each of liver and spleen of the dead guinea-pig was ground separately and diluted with saline. After boiling for 30 minutes, Ascoli precipitation test was carried out with the supernatant clear fluids. The liver and spleen of a healthy animal were used for control.

Serum \ Antigen	Boiled antigen		Boiled viscera of healthy animal		Normal saline
	Liver	Spleen	Liver	Spleen	
Anthrax diagnostic precipitation serum	+	+	—	—	—
Serum of healthy rabbit	—	—	—	—	—

Conclusion: *Bacillus anthracis* Confirmed.

Examined by Cheng Keng, Sc.D.,
Professor of Bacteriology, Department of Veterinary Medicine, College of Agriculture, National Nanking University

Reported by Hsin Chün, M.D.,
Chief Technical Expert of Northeast Epidemic Prevention Institute.

Date of Report: May 20, 1952.

DOCUMENT AA-8

REPORT ON BACTERIOLOGICAL EXAMINATION OF AUTOPSY MATERIAL FROM WEI LIU-SHIH

1. No. of specimen: 498
2. Source of specimen: An-shan.
3. Date received: April 16, 1952.
4. Kinds of specimen: Brain tissue of Wei Liu-shih.
5. Procedure: Right after receiving the specimen, isolation culture and animal inoculation were carried out. When suspicious colonies were found, they were taken for pure culture examination and animal inoculation. Result: From the brain tissue, *Bacillus anthracis* was isolated.
6. Examination of the Pure Culture:

   (1) Morphology: Gram positive spore-bearing bacilli with square ends, those from the animal body showed the presence of capsules and those from the culture media were lined up in long chains. No motility.

   (2) Cultural Properties:

   Blood agar plate: Big and rough colonies with uneven edges, non-transparent and non-hemolytic.

   Plain agar slant: Rapid growth. Rough surface. Semi-transparent.

   Bouillon: Flocculent growth at bottom, supernatant fluid clear.

   (3) Biochemical Properties: Milk—coagulated.
   Gelatin liquefied with inverted fir tree-like growth.

   (4) Pathogenicity in animals: White mouse (18 gms.)—Subcutaneous injection of 0.3 ml. Died in 16 hours.

   (5) Immunological Properties: Ascoli precipitation test—positive.
7. Conclusion: *Bacillus anthracis* was isolated from patient's brain tissue.

Examined by Liu Shih-ming,
Technical Expert, Dairen
Health Research Institute.

Reported by Chu Chi-ming, M.B., Ph.D.,
Chief Technical Expert, National Vaccine
and Serum Institute, Peking.

Date of report: April 27, 1952.

REPORT ON SUPPLEMENTARY EXAMINATION OF BACILLUS ANTHRACIS 498

1) Biochemical properties: It fermented glucose, maltose, sucrose with production of acid but no gas.

It did not ferment salicin, lactose, mannitol, dulcitol, inositol, xylose and arabinose.

H_2S — negative

Indol — negative

Hemolytic test: No hemolysis of the blood cells of goat, rabbit and guinea pig.

Bacterial suspension / 2% R.B.C. suspension	Present Specimen	Control Specimen *(B. Subtilis)*
Goat	no hemolysis	hemolysis
Rabbit	no hemolysis	hemolysis
Guinea pigs	no hemolysis	hemolysis

2) Pathogenicity test on guinea-pig:

A loopful of the pure culture was mixed with 5 ml. of normal saline. 0.5 ml. of this suspension was injected into each of two guinea pigs subcutaneously. Both animals died in 4 days.

Autopsy findings: At the site of injection, there was gelatinous exudate. The liver and spleen were enlarged. The lungs were congested. There were Gram positive square-ended and encapsulated large bacilli in these organs and B. anthracis was isolated from the heart blood.

3) Liver and spleen of dead guinea pigs were used for Ascoli precipitation test—result positive.

Antigen / Serum	Boiled antigen		Boiled normal tissue control		Saline
	Liver	Spleen	Liver	Spleen	
Anti-anthrax diagnostic serum for Ascoli test	+	+	—	—	—
Normal rabbit serum	—	—	—	—	—

Conclusion: *Bacillus anthracis* confirmed.

Examined by Cheng Keng, Sc.D.,
Professor of Bacteriology, Department of Veterinary
Medicine, College of Agriculture,
National Nanking University

Reported by Hsin-Chün, M.D.,
Chief Technical Expert of Northeast Epidemic
Prevention Institute.

Date of Report: June 1, 1952

DOCUMENT AA-9

REPORT ON BACTERIOLOGICAL EXAMINATION OF AUTOPSY MATERIAL FROM WANG TZE-PIN

1. No. of specimen: 422.
2. Source of specimen: North District of Shenyang.
3. Date received: March 25, 1952.
4. Kind of specimen: Brain tissue, heart blood and spleen of Wang Tze-pin.
5. Procedure: Right after receiving the specimen, isolation culture was carried out. When suspicious colonies were found, they were taken for pure culture examination and animal inoculation.
   Result: From the heart blood, brain tissue and spleen *Bacillus anthracis* was isolated. No other organism.
6. Examination of the Pure Culture.

   (1) Morphology: Gram positive spore-bearing bacilli with square ends; those from the animal body have capsules and those from the culture media form long chains. No motility.

   (2) Cultural Properties:

   Blood agar plate: Colonies big, rough, non-transparent, not hemolytic and edge uneven.

   Plain agar slant: Growth rapid. Surface not smooth. Semi-transparent.

   Bouillon: Flocculent precipitation at bottom, supernatant fluid clear.

   (3) Biochemical Properties: Milk—coagulated. Gelatin—liquefied with inverted fir tree-like growth.

   (4) Pathogenicity to animals: White mouse (18 gms.)—Subcutaneous injection of 0.3 ml. Died in 36 hours.

   (5) Immunological properties: Ascoli precipitation test positive.
7. Conclusion: From the heart blood, brain and spleen *Bacillus anthracis* isolated.

Examined by Liu Shih-min,
Technical Expert of Dairen Health
Research Institute.

Reported by Chu Chi-ming, M.B., Ph.D.
Chief Technical Expert,
National Vaccine and Serum Institute, Peking.

Date of report: April 8, 1952.

REPORT ON SUPPLEMENTARY EXAMINATION OF *BACILLUS ANTHRACIS* 422

1 Biochemical Properties:

Fermentation tests: It fermented glucose, maltose and sucrose with production of acid but no gas.

It did not ferment salicin, lactose, mannitol, dulcitol, inositol and arabinose.

H_2S—negative

Indol — negative

Heyolytic test: No hemolysis on the blood cells of goat, rabbit and guinea pig:

Bacterial suspension / 2% RBC suspension	*B. anthracis*	*B. subtilis* (control)
Goat	no hemolysis	hemolysis
Rabbit	no hemolysis	hemolysis
Guinea pig	no hemolysis	hemolysis

2 Pathogenicity test on guinea-pig.

A loopful of the pure culture was mixed with 5 ml. of normal saline. 0.5 ml. of this suspension was injected into 2 guinea pigs subcutaneously. Both guinea pigs died in 3 days.

Autopsy findings: At the site of injection, there was gelatinous exudate. The liver and spleen enlarged. The lungs congested. There were Gram positive square-ended and encapsulated bacilli in these organs. *B. anthracis* was isolated from the heart blood.

3 Liver and spleen of dead guinea pigs for Ascoli precipitation test: positive.

Antigen / Serum	Boiled antigen		Boiled viscera of healthy animal		Normal saline
	Liver	Spleen	Liver	Spleen	
Anthrax diagnostic precipitation serum	+	+	—	—	—
Serum of healthy rabbit	—	—	—	—	—

Conclusion: *Bacillus anthracis* confirmed.

Examined by Cheng Keng, Ph.D.,
Professor of Bacteriology, Department of Veterinary
Medicine, College of Agriculture,
National Nanking University.

Reported by Hsin Chün, M.D.,
Chief Technical Expert of Northeast Epidemic
Prevention Institute.

Date of report: June 1, 1952.

DOCUMENT AA-10

AUTOPSY REPORTS ON FIVE FATAL CASES OF ANTHRAX INFECTION

CASE NO. 1

Name: Chü Chan-yun male age: 55
Residence: Man-ching Station, Ssu-ping City, Liaohsi Province
Occupation: Railway worker (8 yrs.)

Summary of Clinical History:

Present illness: In the morning of March 19th, 1952, he began to have fever, headache, and aching of the extremities. On March 21, he had nausea, vomiting, general malaise, heaviness in the head, pain in the joints and insomnia. In addition, he had cough and the sputum was found to contain encapsulated large Gram positive bacilli. White blood cell count 28000. After admission, he vomited repeatedly. Later he was discovered to have rigidity of neck and mental cloudiness. He died at 2:45 p.m. March 22, 1952.

Date of autopsy: March 23, 1952, 24 hours after death.

Summary of Autopsy Findings:

External examination: Body moderately nourished. Finger nails cyanotic. Superficial lymph glands not enlarged. Skin, no important change.

Peritoneal cavity: No abnormal findings.

Pleural cavity: There is accumulation of about 1000 ml. of fluid in both pleural cavities. Under the left pleura there is ecchymosis.

Pericardial cavity: There is an accumulation of about 100 ml. of fluid.

Heart: No abnormal findings. The heart is in the systolic stage.

Lungs: Show edema and congestion, and there are prominent hemorrhagic spots in the left lower lobe and apex. In the left apex, an old bean-sized tuberculous lesion is found. Hemorrhage in the right lower lung is not marked. The upper lobes of both sides show areas of consolidation. Hilar lymph nodes enlarged.

Liver: Normal in size and color. There is a rice-sized hemorrhagic spot on the upper surface and a millet-sized hemorrhagic spot over the lower surface.

Spleen: Enlarged. Size 20 x 12 x 5 cm. Bluish gray in color.

Stomach and duodenum: Gastric mucosa shows areas of ecchymosis and that of the pyloric region shows hemorrhagic spots. On the duodenal mucosa there are erosions.

Small Intestine: There are 8 ulcerative hemorrhagic areas distributed over the mucosa of the jejunum and ileum. The size of the bigger one is about 1 cm. in diameter and the smaller one is about 0.5 cm. in diameter.

Appendix: There is hemorrhagic inflammatory condition at its tip.

Mesenteric lymph glands: Not enlarged.

Pancreas: There is also an area of ecchymosis, about 2 cm. in diameter.

Bacteriological examinations: *Bacillus anthracis* isolated from both liver and spleen.

Autopsy performed by:

Sung Teh-yü, Director of the Ssu-ping Health Station.
Liu Chan-yuan, Physician of the Ssuping Health Station.

Comment:

From the clinical records, we may conclude that the patient had a severe generalized acute infection. Cough, leucocytosis and the finding of large Gram positive bacilli in the sputum clearly point to anthrax infection of the respiratory tract. Bilateral pleural effusion, hemorrhagic spots on the visceral pleura of the lungs, pericardial effusion, consolidation of the upper lobes of both lungs, enlargement of hilar lymph glands and splenic enlargement establish the diagnosis of pulmonary anthrax.

The isolation of *Bacillus anthracis* from the liver and spleen speaks for septicemia. Clinical symptoms such as loss of consciousness and rigidity of the neck indicate meningitis. The ulcers and hemorrhagic spot in the mucosa of small intestines are probably produced by bacilli swallowed with the sputum, but as the mesenteric glands are not enlarged, it is apparent that the intestinal lesion is not a primary anthrax infection.

Reported by: Wu Tsai-tung, M. B.
Professor of Pathology, Nanking University Medical College.
Li Pei-lin, M. B., Ch. B., Ph. D.
Professor of Pathology, National Medical College, Shenyang.

CASE NO. 2

Name: Wang Tze-pin male age: 47
Residence: Shenyang.
Occupation: Tricycle-rickshaw driver.

Summary of Clinical History:

Present illness: At 10:30 p.m. on March 20, 1952 the patient began to feel general discomfort. On March 21, he rested in bed. His ap-

petite remained good and he was still able to move about. On March 22, he experienced soreness of legs, general malaise, discomfort in the upper abdomen, nausea and headache. In the morning of March 23, he felt better. But at 5 p.m. he experienced constricting sensation all over the whole body and distension over the upper abdomen. He was mentally clear until 6 a.m. March 24, when he gradually developed mental cloudiness with aphasia and restlessness. He was then sent to the First Municipal Hospital at 9 a.m., where he was examined with the following findings:

Temperature 36°C, Pulse imperceptible. Comatose. Pupils dilated with no reaction to light. Bulbar conjunctivae congested. Lips cyanotic. Mouth tightly closed. Heart sounds indistinct. Neck rigid. Kernig's sign positive.

The patient died at 9:35 a.m. on March 25, 1952.

Autopsy was performed 5 hours after death.

Summary of Autopsy Findings:

The body is that of a stout man. Nutritional status good. External examination of the body, including the skin, reveals no abnormal findings. The right pleural cavity contains about 1300 ml. of yellow clear fluid and the left contains about 500 ml. In the pericardial cavity, there is approximately 100 ml. of light yellow clear fluid.

Heart: Weight 340 gm. No important pathological changes.

Lungs: Right lung weighs 490 gms. The visceral pleura is smooth, except the portion near the mediastinum which shows definite gelatinous oedema. On palpation of the lung tissue, no consolidation is found. But on the cut surfaces, thickening of the peribronchial tissues is seen. The interlobular tissue of the lower lobe also shows the same thickenings with edema. The parenchymatous tissue of the lung shows no remarkable change, except for edema of varying degrees. The bronchus and the bronchioles show mild degree of congestion but no erosion or ulcer. The tissues around the bronchus and the lower end of the trachea and the adjacent lymph glands form a hemorrhagic mass measuring about 5 X 3 X 2.5 cm. The surrounding hilar tissue of the lungs is edematous.

Left lung weighs 340 gms. No important pathological change.

Under the microscope, the tissues of the hilum of the right lung and the lymph glands show marked infiltration with polymorphonuclear leucocytes and diffuse hemorrhage. In a small bronchus, the following changes are noted: Desquamation of epithelial cells, edema of bronchial wall and infiltration with polymorphonuclear leucocytes. The lung tissue, besides marked edema, shows no important changes. In the sections stained with Gram method there are large Gram positive bacilli in the wall of the small bronchus as mentioned above and in the neighbouring lymph

glands. In the interlobular tissue of the right lower lung there are marked edema and mild infiltration with polymorphonuclear leucocytes and mononuclear cells.

Intestines: In the upper portion of the jejunum there is a bean-sized hemorrhagic area with an ulceration seen in its center and red discoloration around. On the mucous membrane of the colon, there are also more than ten isolated pea-sized hemorrhagic spots more numerous in the ascending colon. Under microscope, the mucous membrane of the intestine shows fibrin and polymorphonuclear leucocytic infiltration with a number of Gram positive square-ended bacilli. The lymph tissue of the wall of intestine is normal with no polymorphonuclear infiltration. Mesenteric lymph glands normal.

Brain: The dura mater shows no change. The blood vessels on the surface of the brain congested. There is marked diffuse hemorrhage in the subarachnoid space. The vessels at the base of the brain show no sclerotic change. The vessels in the meninges of the spinal cord are congested. Under the microscope, there are diffuse hemorrhages and polymorphonuclear and mononuclear infiltrations in the subarachnoid space. The small vessels inside the brain are congested and in the perivascular tissue there are polymorphonuclear and mononuclear infiltrations and many foci of hemorrhage. The lumen of a blood vessel extending from the meninges into the brain parenchyma is found to be full of bacilli. In the wall of that vessel there is polymorphonuclear leucocytic infiltration with perivascular hemorrhage. In the Gram stained sections many Gram positive square ended bacilli are found in the subarachnoid space.

The *liver, spleen and other organs* show no important changes.

Bacteriological culture: *Bacillus anthracis* was isolated from the heart blood, brain and spleen.

Diagnosis: Hemorrhagic anthrax meningitis, anthrax bronchitis, peribronchitis and interlobular cellulitis of the right lower lobe. Purulent hemorrhagic anthrax lymphadenitis of the hilar lymph glands. Pulmonary edema with pleural effusion. Pericardial effusion. Multiple necrosis and ulcerations of the mucous membrane of the intestine due to anthrax bacillus infection.

Autopsy by Drs. Chu Feng-chun and Wang Hung-lieh, Department of Pathology, National Medical College, Shenyang.

Reexamined and confirmed by:

Wu Tsai-tung M. B.., Professor of Pathology, Nanking University Medical College.

Li Pei-lin, M. B., Ch. B., Ph. D.
Professor of Pathology, National Medical College, Shenyang.

CASE NO. 3A

Name: Wei Liu shih female age: 32
Residence: Anshan

Summary of Clinical History:

Present illness: The patient had repeatedly joined the work of catching and killing insects disseminated by American airplanes before contracting the present illness. In the evening of April 11, 1952, the patient felt slight general discomfort. On April 12, she experienced headache, chilliness and fever, but still carried on her household duties. On April 13, the symptoms increased in severity so that she became bed-ridden and had cough, chest pain, dyspnea and vomiting. Then, only with great difficulty was she able to go to the Second Combined Clinic in the Tieh-tung District for treatment. After she returned home, the symptoms became progressively worse. On April 14, she was sent to Anshan Municipal Tieh-tung Health Station where she was found in a state of mental confusion, delirium and restlessness, with labored respiration, frequent convulsions, imperceptible pulse, a pale face, cyanotic lips, tightly closed mouth and dilated pupils. Light reflexes of the pupils were sluggish. The neck was very rigid; Kernig's sign positive. Moist rales in the lungs were detected on both sides of the chest. She died at 11:50 p.m. on April 14.

Autopsy performed 21 hours after death.

Summary of Autopsy Findings:

The body is that of a middle-aged woman, normally developed and moderately well-nourished. External examination shows no abnormal findings. Each pleural cavity contains about 1000 ml. of slightly turbid fluid orange in color. The pericardial cavity contains 150 ml. of orange-colored fluid.

Heart: Weight 230 gm. No pathological change.

Lungs: On the back of the lower lobe of the left lung, there is a firm area which measures about 4 X 3 cm. in size. The cut surface appears to be dark red in color, within which there is a fan-shaped area measuring 2 X 1.5 cm. and appearing grayish yellow in color. The bronchial mucosa is slightly congested. Microscopic examination reveals necrotizing pneumonitis and the presence of Gram-positive bacilli. The hilar lymph nodes are markedly enlarged to the size of a pigeon's egg. On section, hemorrhagic lesions can be seen on the cut surface of these lymph nodes. Microscopic examinations reveal hemorrhagic lymphadenitis and the presence of Gram positive square-ended bacilli.

Liver: Congested.

Spleen: Enlarged, weighing 400 gm. It is very soft in consistency. Post-mortem changes are very prominent.

Gastro-intestinal tract: Shows no abnormal findings.

Uterus: Gravid, containing a fetus measuring 15 cm. in length.

Brain and spinal cord: On the surface of the cerebrum in the subarachnoid space there are diffuse hemorrhages. In some areas the sulci and gyri can not be distinguished, being completely covered by blood. There are also diffuse hemorrhages on the surface of cerebellum and the base of the brain. Purulent exudate is not found. Diffuse hemorrhages are also present in the subarachnoid space of the spinal cord. The meningeal vessels are extremely congested. The blood vessels of the base of the brain show no arteriosclerosis or other changes.

Microscopic examinations reveal extremely prominent hemorrhages in the subarachnoid space, being filled with large numbers of red blood cells. There is also infiltration of polymorphonuclear leucocytes and a small number of large mononuclear cells. In Gram-stained slides it is found in the above-mentioned hemorrhagic areas numerous large Gram-positive bacilli, some of which are arranged in the form of bamboo, morphologically identical with *Bacillus anthracis*.

Other organs: No significant changes.

Bacterial culture: *Bacillus anthracis* was isolated from the brain tissue.

Diagnosis: Hemorrhagic anthrax meningitis, necrotizing anthrax pneumonitis of the lower lobe of the left lung, hemorrhagic anthrax lymphadenitis of the hilum of the lungs, edema of the lungs, bilateral pleural effusion, pericardial effusion and acute splenic tumor.

The autopsy was performed by Drs. Chiang Ying-kai and Kuo Cheng-teh, Department of Pathology of the National Medical College, Shenyang.

On reexamination of the pathological material we confirm the above diagnosis.

Reported by:

Wu Tsai-tung, M. B.,
Professor of Pathology, Nanking University Medical College.

Li Pei-lin, M. B., Ch. B., Ph. D.,
Professor of Pathology, National Medical College, Shenyang.

CASE NO. 3B

Name: Wang Shu-chih. Female Age: 23
Residence: Liu-erh-pu, Liaoyang County.
Occupation: Primary school teacher.

Summary of Clinical History:

The patient was healthy in the past, without any chronic illness. After the American planes had dropped insects, she participated in the

work of catching and killing insects. She worked till 10 p.m. every night. Two days before her death (April 6, 1952) she felt dryness in the throat with hoarseness of voice. At times she had headache and pain in her joints. She was still able to carry on her usual work until 9 a.m. on April 8, when she lost her consciousness while she was in the toilet. This was discovered by her colleagues and she was moved to her own room. Her respiration was dyspneic, with white frothy discharge mixed with blood escaping from her mouth. Light reflex lost. Fingers cyanotic. She died at 10:35 a.m. on the same day.

Summary of Autopsy Findings:

Time of autopsy: 24 hours after death.

The body is well developed and well nourished. There is no abnormal findings on the surface of the body.

Chest cavity: There is no excessive fluid in both pleural cavities. The anterior surface of the right lung shows fibrous adhesions. The heart is 290 gms. in weight. The pericardium is smooth and shining. A few hemorrhagic spots are seen on the surface of the left ventricle. The endocardium is stained red by hemoglobin. The valves are normal. Both ventricles slightly dilated. Myocardium is soft.

The anterior surface of the right lung shows fibrous adhesion, while the rest of pleura shows no changes. The posterior portions of both left and right lungs show marked congestion but no definite consolidation.

Microscopically, besides the edema in most of the alveoli of the lungs, there is also polymorphonuclear leucocytic and monocytic infiltration in some of the alveoli of the right upper lobe. The mucous membrane of the bronchioles is detached, and in the lumens of the bronchioles there is cellular exudate. In the Gram stained slides, scattered large Gram positive bacilli are seen. The two ends of the bacteria appear square. Inside some alveoli and vesesls, such large bacilli are also seen, but in areas without inflammatory changes no such bacilli are seen.

Liver: Capsule smooth. Cut surface shows prominent cloudy swelling. A few Gram positive bacilli are also seen under the microscope in the hepatic sinuses.

Spleen: No important changes.

Gastro-intestinal tract and mesenteric lymph glands: No change.

Other organs: Also no remarkable change.

Brain and spinal cord: There is diffuse hemorrhage in the subarachnoid space of both brain and spinal cord. On the coronal section of the cerebrum, hemorrhages are also seen beneath the ependyma of the left and the 4th ventricles. The artery of the base of the brain shows no sclerotic changes.

Microscopically, diffuse hemorrhage can be seen in the subarachnoid space. But the infiltration of the meninges by polymorphonuclear leucocytes is very slight. In Gram stained slides, the small vessels of the brain and meninges contain Gram-positive bacilli.

No bacteriological culture done.

Diagnosis: Acute hemorrhagic anthrax meningitis. Bronchopneumonia of the right upper lung. Pulmonary edema.

Autopsy performed by Drs. Chao Wen-tou and Wang Hung-lieh, Department of Pathology, National Medical College, Shenyang.

The autopsy findings point to acute hemorrhagic anthrax meningitis, bronchopneumonia of right upper lobe and pulmonary oedema. In the pathological sections large Gram positive bacilli with square ends, morphologically identical with *B. anthracis* were found. So the diagnosis of anthrax infection is beyond any doubt.

Reported by: Wu Tsai-tung, M. B.,
Professor of Pathology, Nanking University Medical College.

Li Pei-lin, M. B., Ch. B., Ph. D.,
Professor of Pathology, National Medical College, Shenyang.

CASE NO. 4

Name: Tien Cheng-ho. Male. Age: 44.

Residence: First Section of the Eastern Shuang-shan Village, 5th District of Antung County.

Occupation: Farmer.

Clinical History: In the morning of April 16, 1952, after sending out 3 cartloads of manure into the field, he suddenly experienced chilliness. He immediately returned home and rested. The symptoms at that time were generalized joint pain, fever and mild headache. Food intake was as usual. On April 17, symptoms became worse, he was still able to take food, but vomited twice. On April 18, after dawn, he became unconscious. Both hands were tightly clenched as in spasm. A local doctor named Lin Hou was sent for. Body Temp. was 38.7°C. No definite diagnosis was made. He died on the same day (April 18) at 12, noon.

Gross Findings on Autopsy:

Time of autopsy: April 19, 5:00 p.m. (29 hours after death) at the home of the deceased.

The body is that of a male. Livor mortis over the back prominent. No generalized edema. No enlargement of lymph glands. Pupils 0.5

cm. in diameter. Conjunctivae pale. During the removal of clothes some fresh red fluid comes out from the nostrils. No fluid in the *peritoneal cavity*. Peritoneum normal. *Stomach* markedly dilated. Gastric mucous membrane smooth. Under the serosa of the greater curvature of the stomach, there scatter a number of hemorrhagic areas about the size of finger tips. The surface of *intestine* shows no particular change. *Mesenteric lymph glands* not enlarged.

Liver weighs 1200 gms. Surface smooth and grayish purple, showing postmortem autolysis. Cut surface dark purple with also autolytic changes. *Gall bladder* shows no inflammatory changes. *Spleen* weighs 200 gms. a little bigger than a palm, measuring 7 finger-breadths in length and 5 finger-breadths in width, dark purplish red in color. Surface smooth, cut surface was purplish black. The tissue also shows evidence of autolysis. Each kidney weighs 150 gms. The right *kidney* is 6 finger-breadths in length and 3 finger-breadths in width. Surface smooth and dark red. Cut surface dark purple and the tissue also shows post-mortem autolysis. The left kidney shows similar findings.

In the *pleural cavity*, there is no inflammatory exudate. The parietal pleura shows no adhesions. There is 15 ml. of dark red fluid in the *pericardial cavity*. Epicardium rich in fat. The *heart* is in a relaxed state with a blunt apex. The myocardium also shows postmortem autolysis. No other changes seen. Valves normal. Weight 250 gms. *Lungs* dark bluish gray, and cut surface purplish black showing hemorrhagic changes. The right lung weighs 850 gms. the left lung 700 gms. The hilar lymph glands are about the size of a thumb.

Cranial cavity: Dura mater normal. Under the leptomeninges, there is diffuse hemorrhage. Subarachnoid space filled with blood. Cut surface *of brain* showed no hemorrhagic spots. No inflammatory exudate in the cranial cavity.

In summarizing the above findings, it may be said that the body shows very marked postmortem changes, hemorrhages in subarachnoid space, in serosa of stomach and in the lungs and there is enlargement of the hilum lymph glands of the lungs.

Results of Bacteriological Examination:

(1) Direct smears of the brain tissue, lungs, spleen and kidneys stained with Gram method reveal numerous Gram positive bamboo-like large bacilli.

(2) From bacteriological culture and animal inoculation of the heart blood, brain tissue, lung, liver, spleen and kidney *Bacillus anthracis* was isolated.

Based on the above findings, the diagnosis is that the patient died of anthrax bacillus septicemia.

Examined by

Sung Wei-yi, Superintendent of Liaotung Municipal Hospital.

Kao Chuan-li, Physician of Antung Municipal Hospital.

Wang Chun-lin, Laboratory Technician of Antung Municipal Hospital.

The organism isolated from this patient was reexamined and confirmed as *Bacillus anthracis* by bacteriologists Hsin Chün and Cheng Keng.

The clinical manifestations fit in with the diagnosis of anthrax septicaemia and meningitis. Post-mortem examination revealed lesions of hemorrhagic meningitis. The gnding of *B. anthracis* from direct smear and culture of internal organs would confirm the diagnosis of septicaemia. There was increase of weight of both lungs. Cut surface showed congestion, hemorrhages and oedema. Hilum glands were enlarged. The primary focus was evidently in the lungs and the infection was introduced through the respiratory route.

Reported by

Wu Tsai-tung, M.B.
Professor of Pathology,
Nanking University Medical College.

Li Pei-lin, M.B., Ch. B., Ph.D.
Professor of Pathology,
National Medical College, Shenyang.

TABULAR SUMMARY OF 5 CASES OF ANTHRAX INFECTION

	Case number	1	2	3a	3b	4
	Name	Chü Chan-yun	Wang Tze-pin	Wei Liu-shih	Wang Shu-chih	Tien Cheng-ho
	Sex	Male	Male	Female	Female	Male
	Age	55	47	32	23	44
	Occupation	Railway worker	Tricycle-rickshaw driver	House wife	Primary school teacher	Farmer
	Date of onset of disease	March 19 1952 A.M.	March 20 1952 Night	April 11 1952 Night	April 6 1952	April 16 1952
	Date of death	March 22 1952 at 2:45 p.m.	March 25 1952 at 9:35 a.m.	April 14 1952 at 11:50 p.m.	April 8 1952 at 10:35 a.m.	April 18 1952 at 12 noon
	Time of autopsy	24 hrs. after death	5 hrs. after death	21 hrs after death	24 hrs. after death	29 hrs. after death
Clinical manifestations	Fever	+		+		+
	Headache	+	+	+	+	+
	General aching	+	—	—	+	+
	Cough	+	—	+	—	—
	Nausea and vomiting	+	+	+	—	+
	Meningeal irritation	+	+	+	—	+
	Coma	+	+	+	+	+
	Abdominal pain	—	±	—	—	—
Pathological findings	Pneumonia or bronchitis	+	+	+	+	+
	Pulmonary congestion and oedema	+	+	+	+	+
	Enlargement hilum glands	+	+	+	—	+
	Pleural effusion	+	+	+	—	—
	Pericardial effusion	+	+	+	—	—
	Hemorrhagic meningitis		+	+	+	+
	Intestinal ulcer	+	+	—	—	—
	Enlarged mesenteric glands	—	—	—	—	—
	Skin anthrax	—	—	—	—	—

DOCUMENT AA-11

Epidemiological Investigation of Five Fatal Cases of Anthrax Infection

Case No.	1	2	3a	3b	4
Name	Chü Chan-yun	Wang Tze-pin	Wei Liu-shih	Wang Shu-chih	Tien Cheng-ho
Age	55	47	32	23	44
Sex	Male	Male	Female	Female	Male
Residence	Man-ching Station nearby Ssuping	City district of Shenyang	City district of Anshan	Liu-erh-pu Town of Liaoyang Hsien	East Shuang-shan Village, 5th District, Antung Hsien
Occupation	Railway worker	Tricycle-rickshaw driver	House wife	Primary school teacher	Farmer
How infected	During extermination of flies dropped by American airplane	Disease developed after the dissemination by American airplanes of insects and objects in the Shenyang District	During extermination of ptinid beetles dropped by American airplanes	During extermination of ptinid beetles dropped by American airplanes	During disposal of the feather dropped by American planes
Pathological diagnosis	Anthrax of resp. system, (brain and meninges not examined).	Anthrax of resp. system, anthrax meningitis	Anthrax of resp. system, anthrax meningitis	Anthrax of resp. system, anthrax meningitis	Anthrax of respiratory system and anthrax meningitis
History of contact with furs or leather	No	No	No	No	No
History of using new tooth-brush or shaving-brush	Not used	Not used	Not used	Not used	Not used
History of contact with diseased farming animals	Only a donkey in the district of Manching Station, not sick	No farming animal in the neighbourhood			Although he was a farmer, no history of contact
Any domestic animals suffering from anthrax	No	No	No	No	No
Any neighbours suffering from anthrax	Before and after their death, no neighbour suffered from any type of anthrax				
Any manure near their residence	No	No	No	No	No
Disposal of the corpse	By incineration after autopsy				

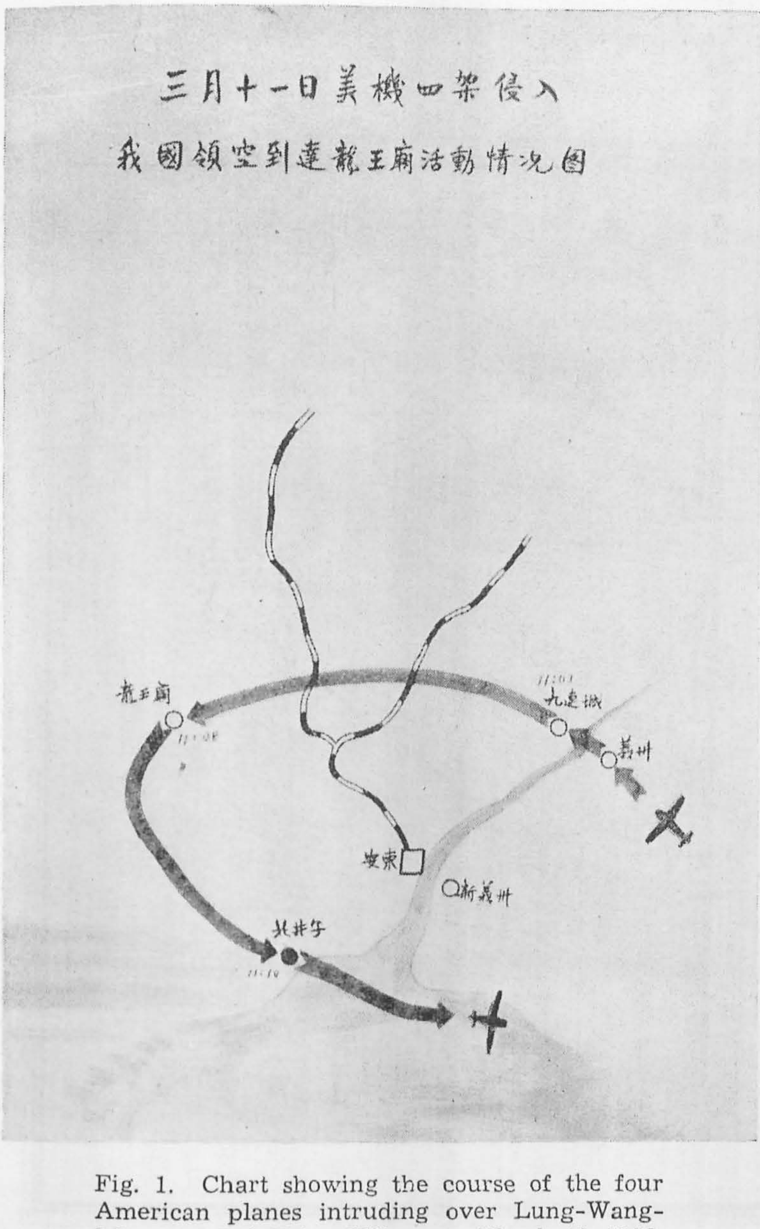


Fig. 1. Chart showing the course of the four American planes intruding over Lung-Wang-Miao and Pei Ching Village on March 11, 1952.

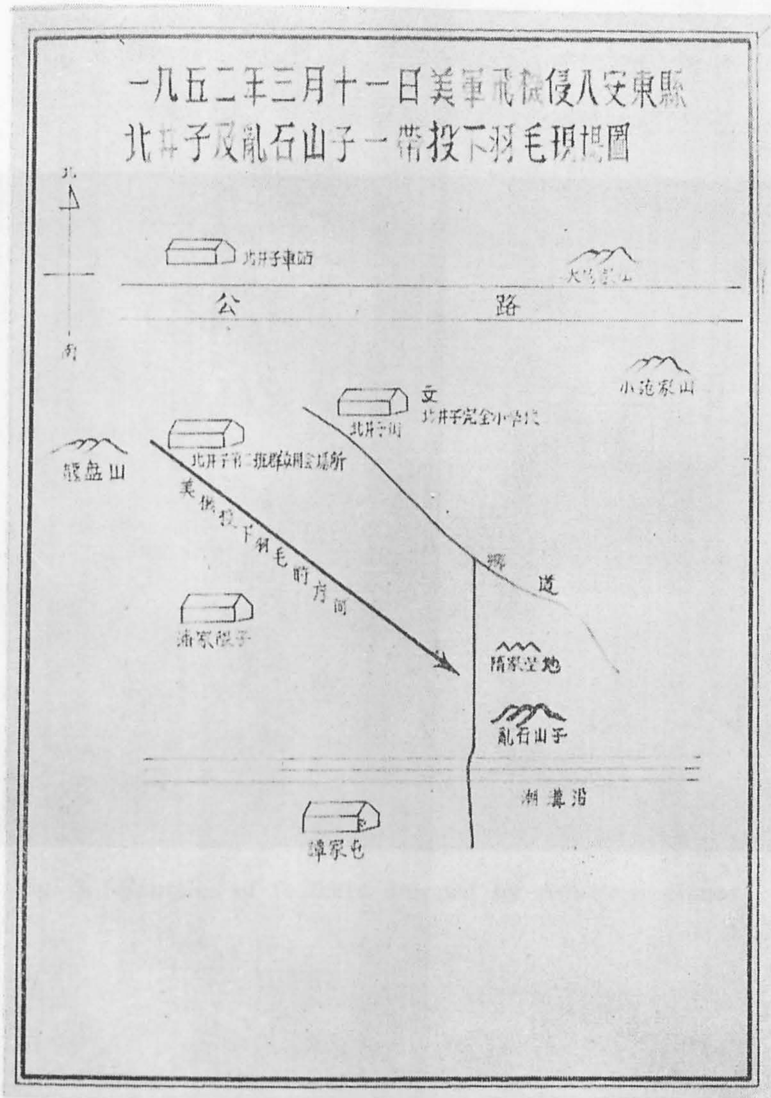


Fig. 2. Chart showing the localities of Pei-Ching-Tzu and Luan-Shih-Shan-Tzu in Antung where American planes dropped feathers on March 11, 1952.

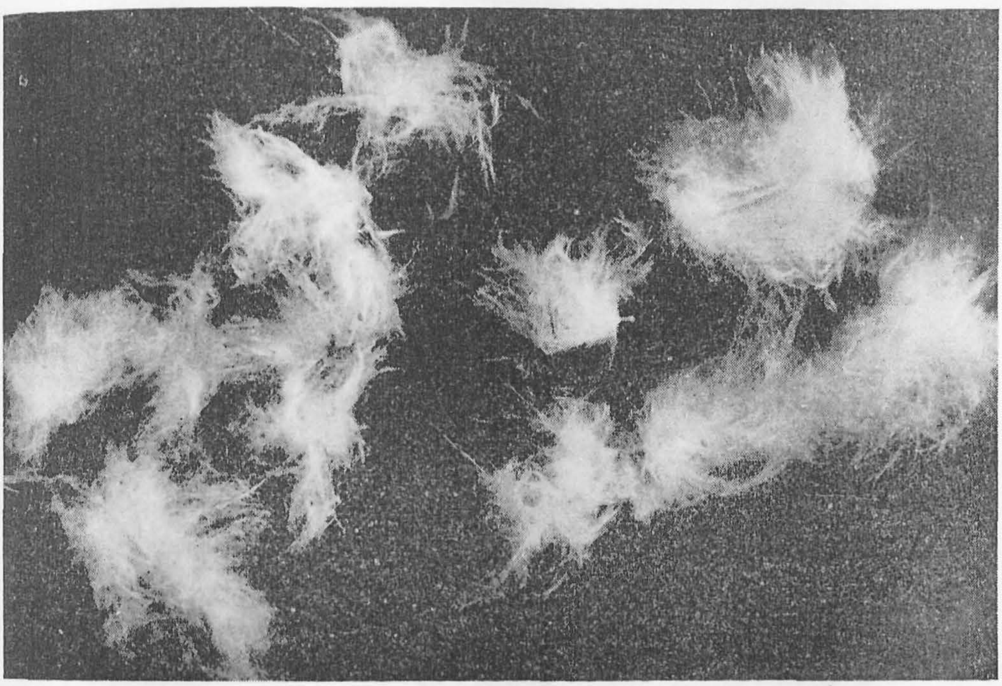


Fig. 3. Samples of feathers dropped by American planes.

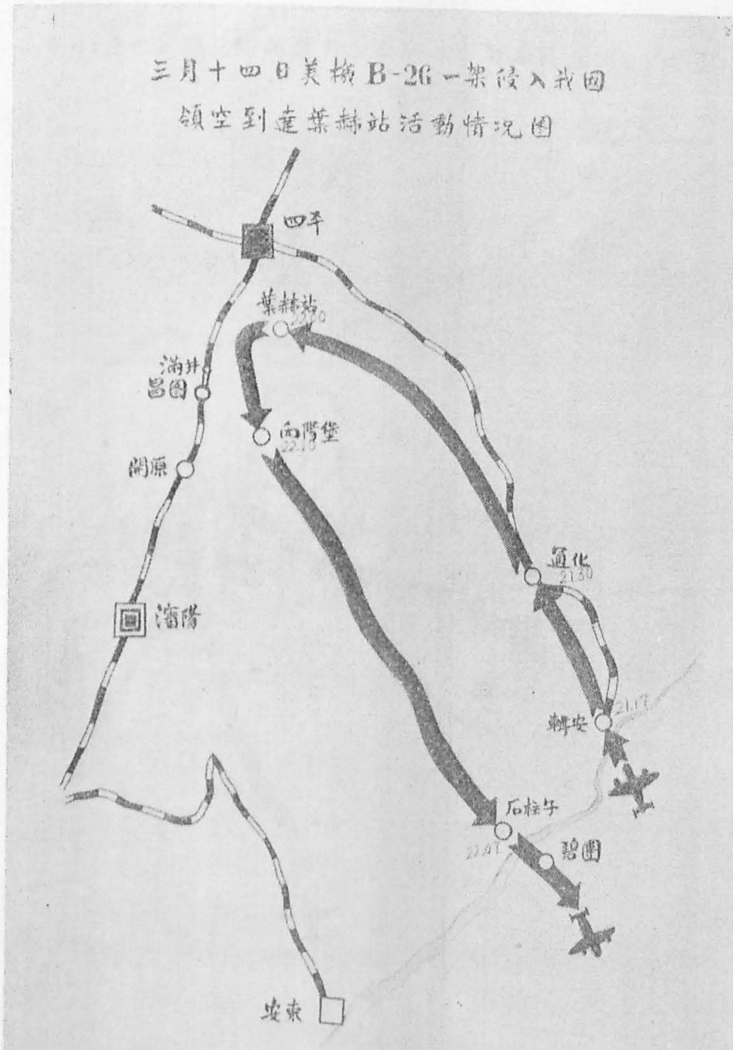


Fig. 4. Chart showing the course of an American plane B-26 intruding over Ssu-Ping and Man-Ching on March 14, 1952.

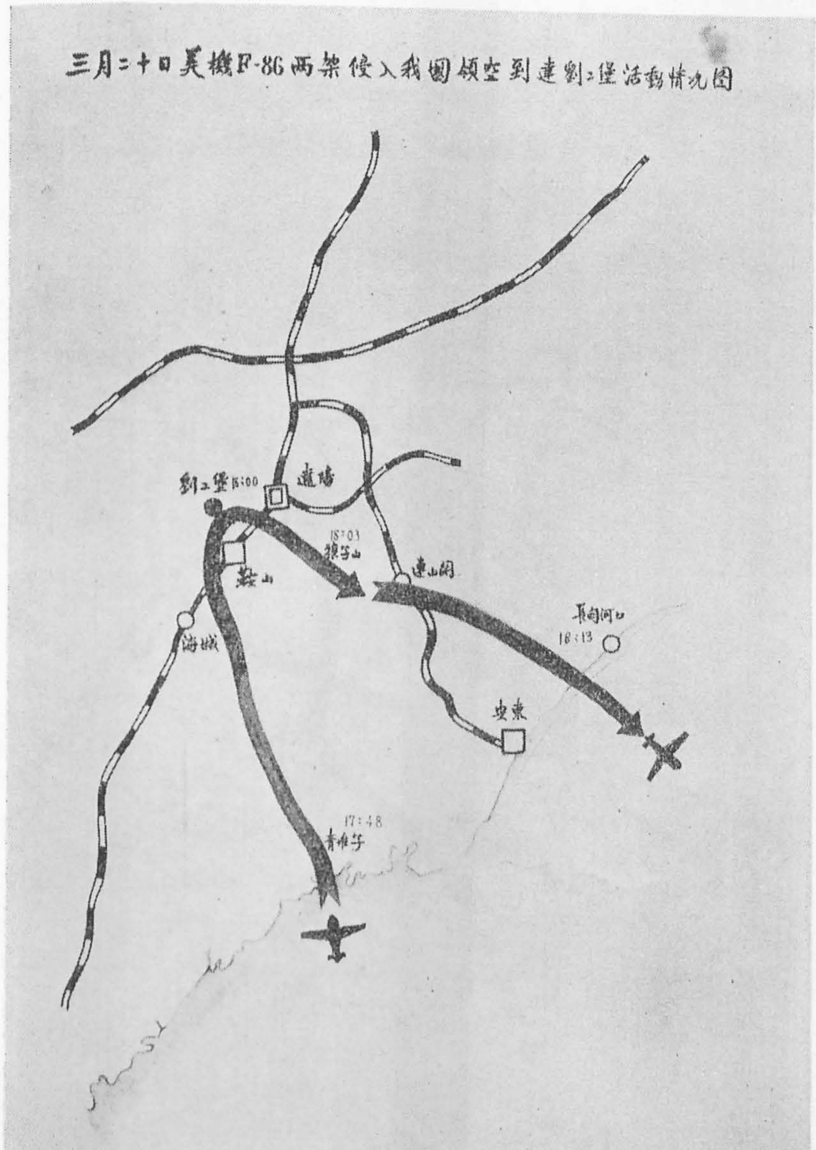


Fig. 5. Chart showing the course of two American F-86 planes intruding over Liu-Erh-Pu on March 20, 1952.

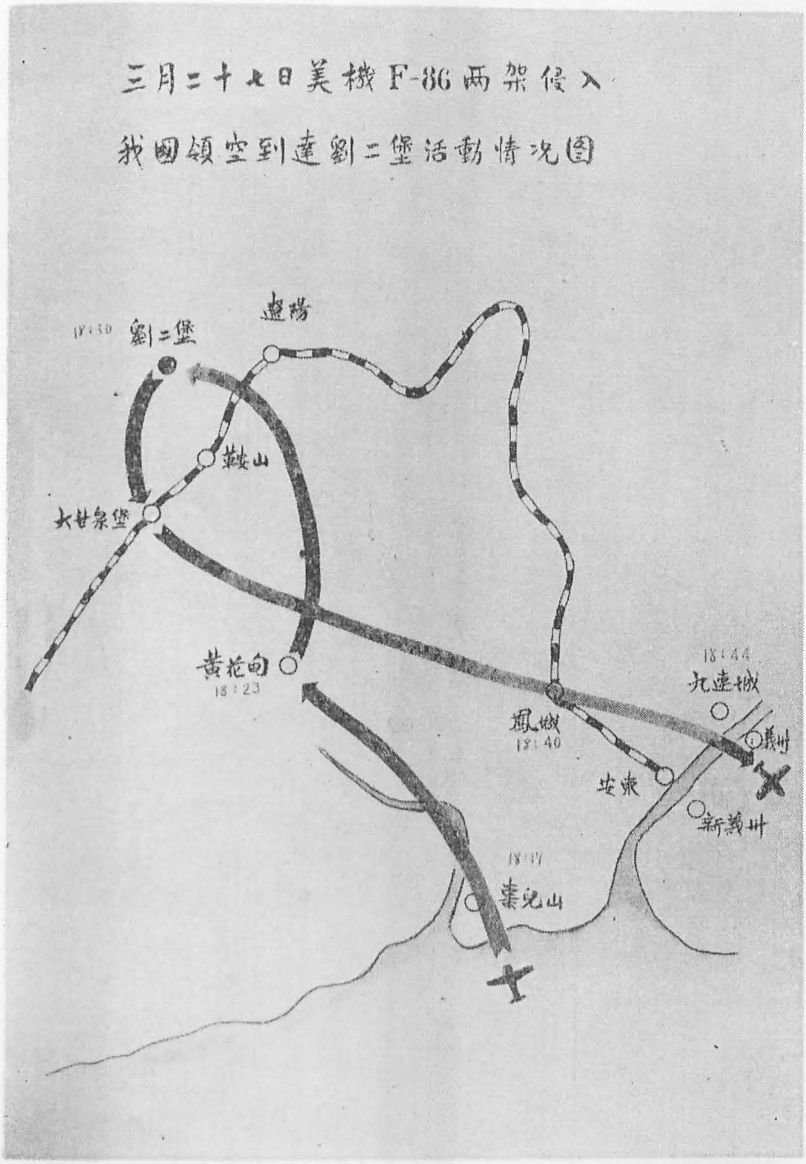


Fig. 6. Chart showing the course of two American F-86 planes intruding over Liu-Erh-Pu on March 27, 1952.

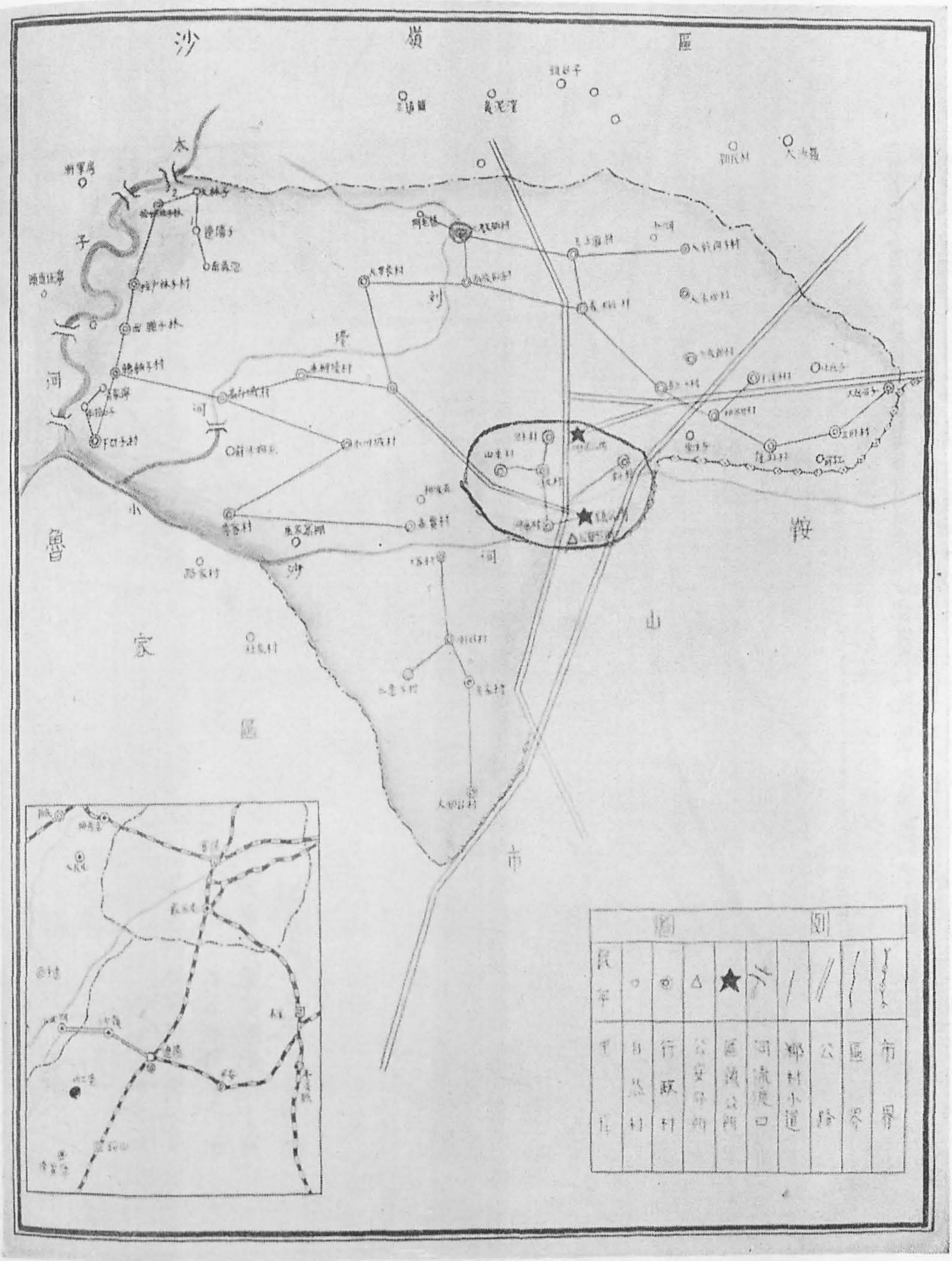


Fig. 7. Map of Liu-Erh-Pu, Liaoyang Hsien.

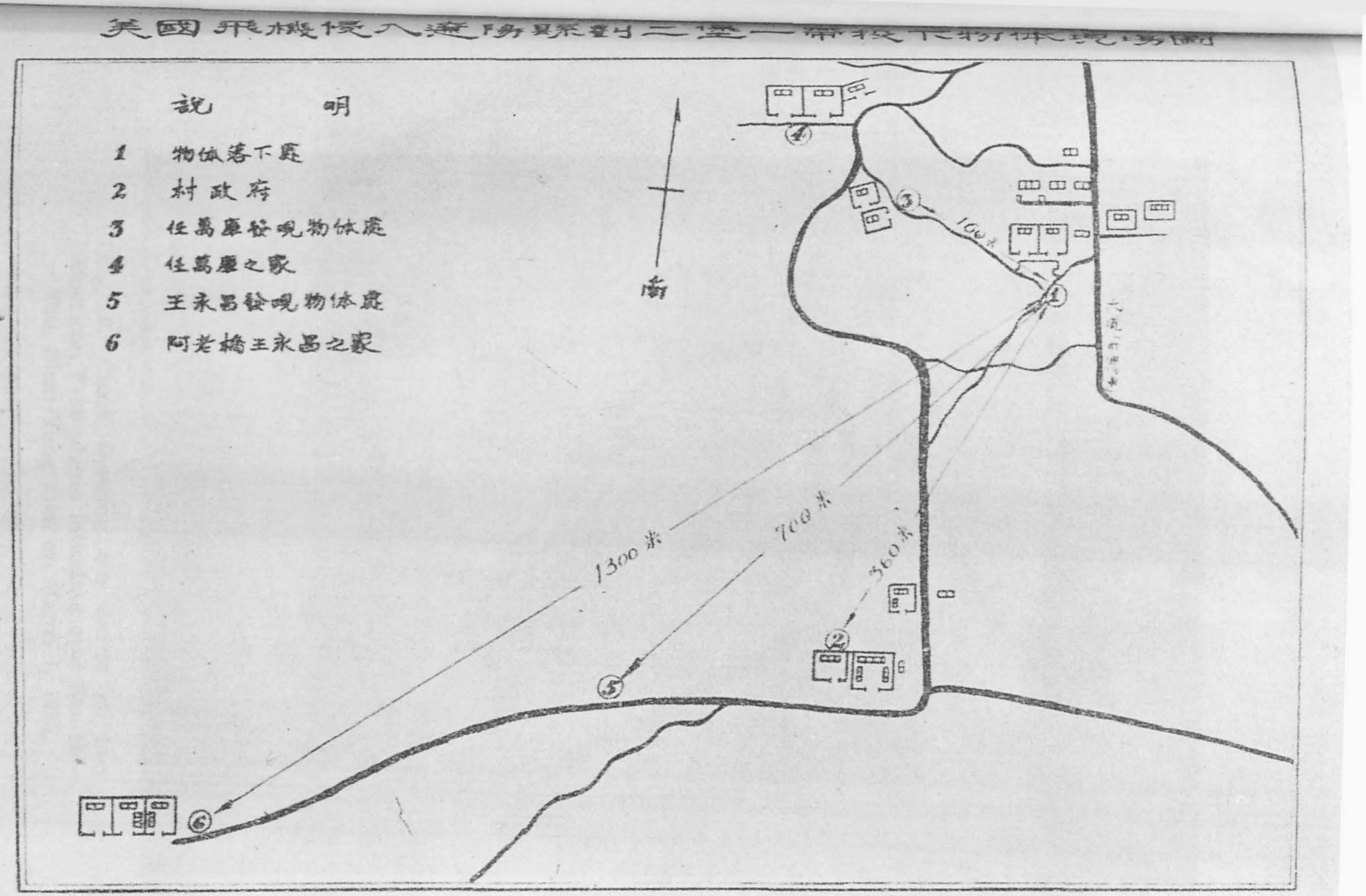


Fig. 8. Map of Liu-Erh-Pu in Liaoyang Hsien where American planes dropped objects. (Explanation: 1. Location where the falling object was seen; 2. Village Government; 3. Location where Jen Wan-Ku discovered the objects; 4. House of Jen Wan-Ku; 5. Location where Wang Yung-Chang discovered the objects; 6. House of Wang Yung-Chang at Ah-Lao-Chiao.

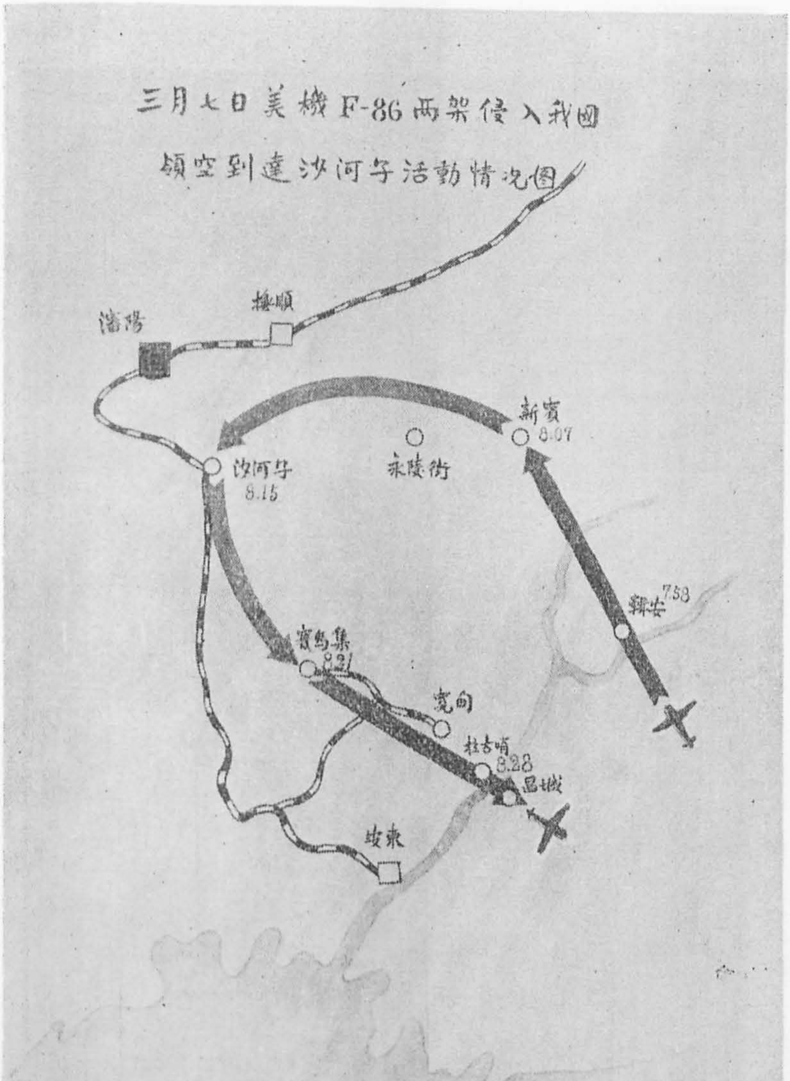


Fig. 9. Chart showing the course of two American F-86 planes intruding over Sha-Ho-Tzu, Shen-Yang area on March 7, 1952.

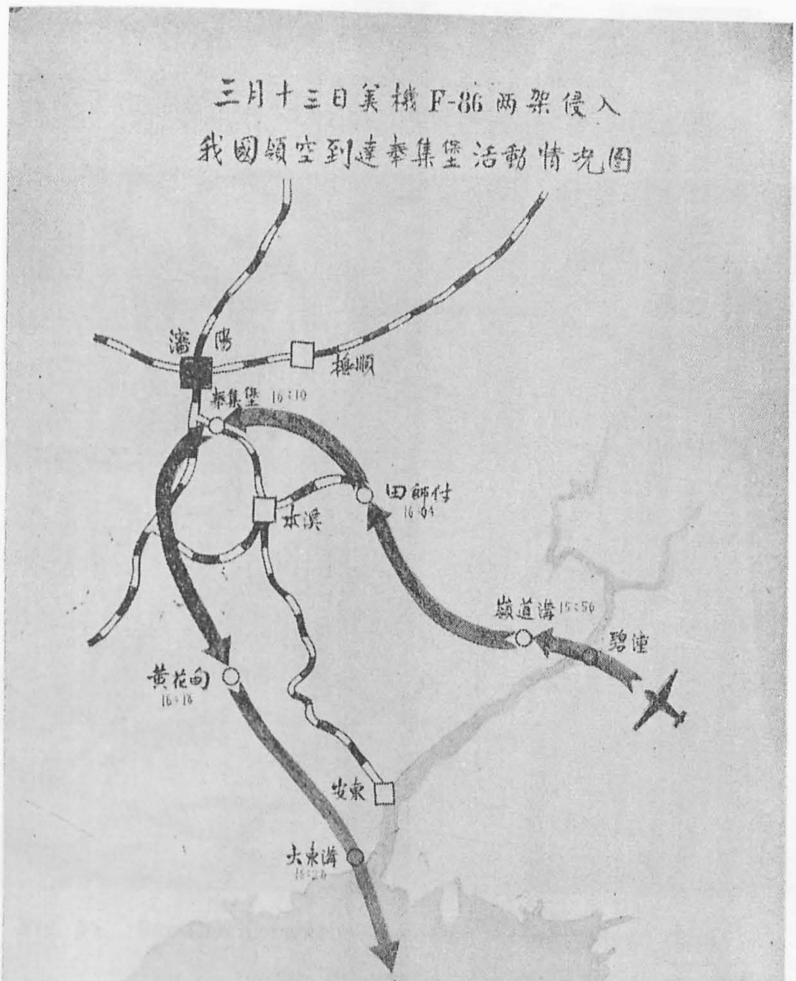


Fig. 10. Chart showing the course of two American F-86 planes intruding over Feng-Chi-Pu, Shen-Yang area on March 13, 1952.

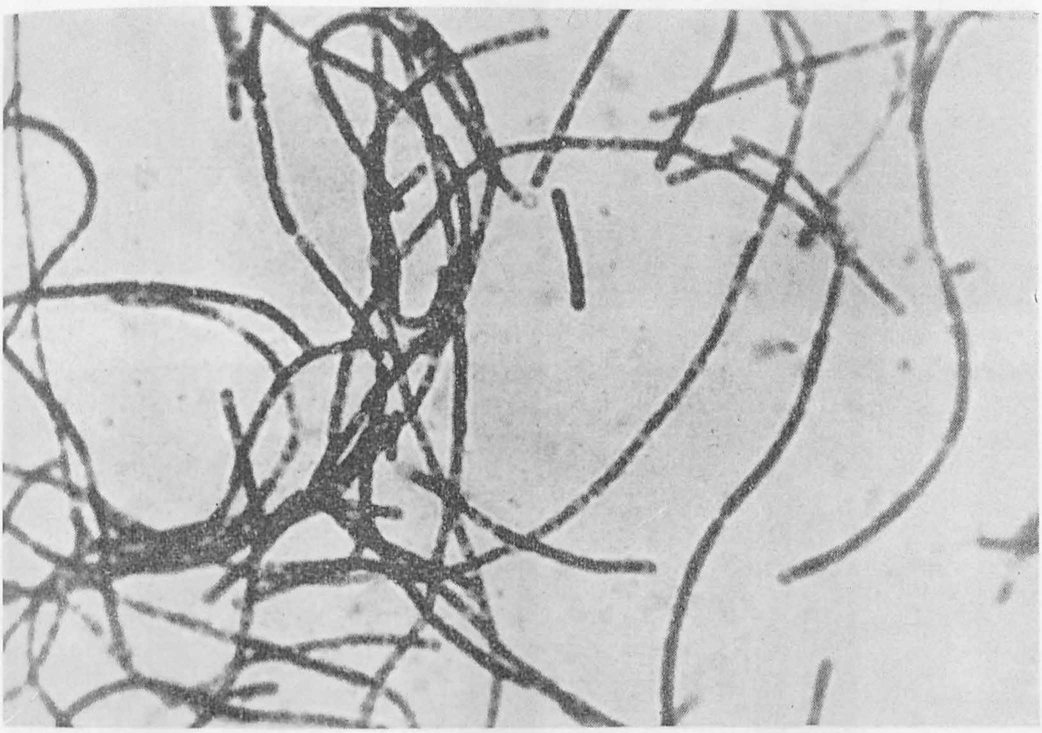


Fig. 11. *Bacillus anthracis*—stained with methylene blue.

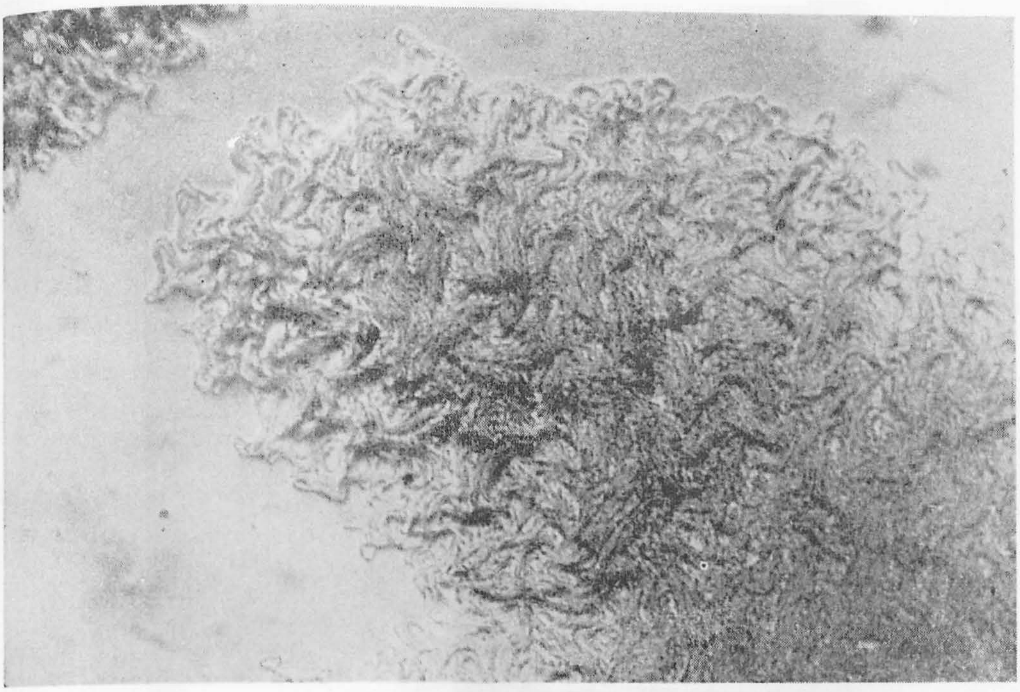


Fig. 12. Colonies of *B. anthracis.*

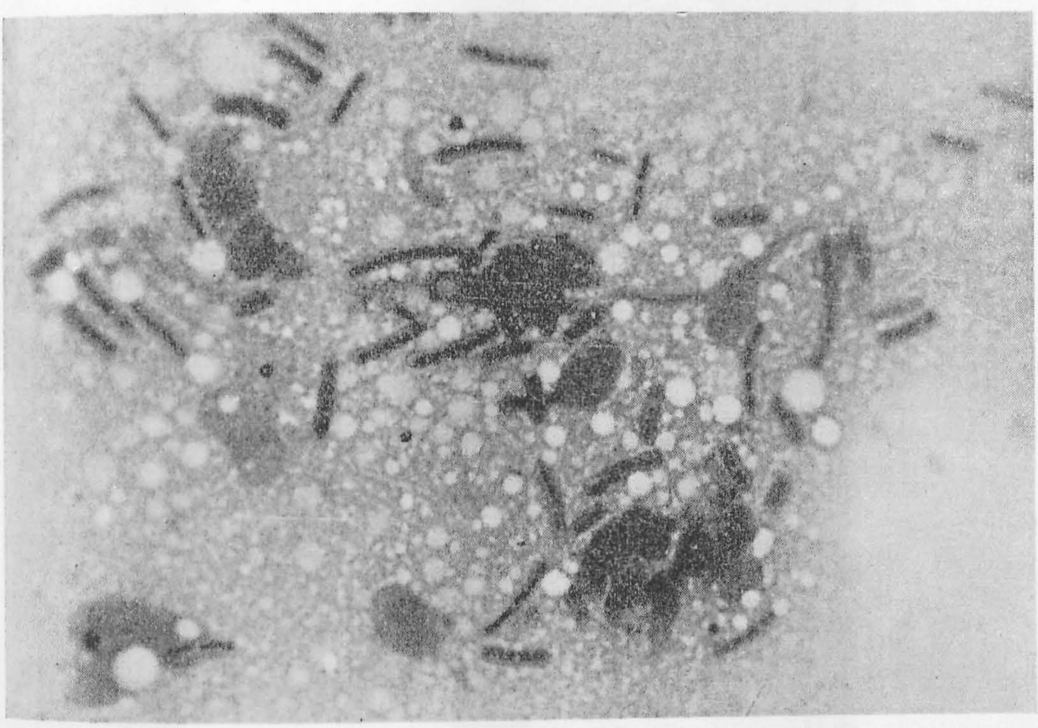


Fig. 13. Smear of the spleen of an infected mouse, showing capsule formation of *B. anthracis.*

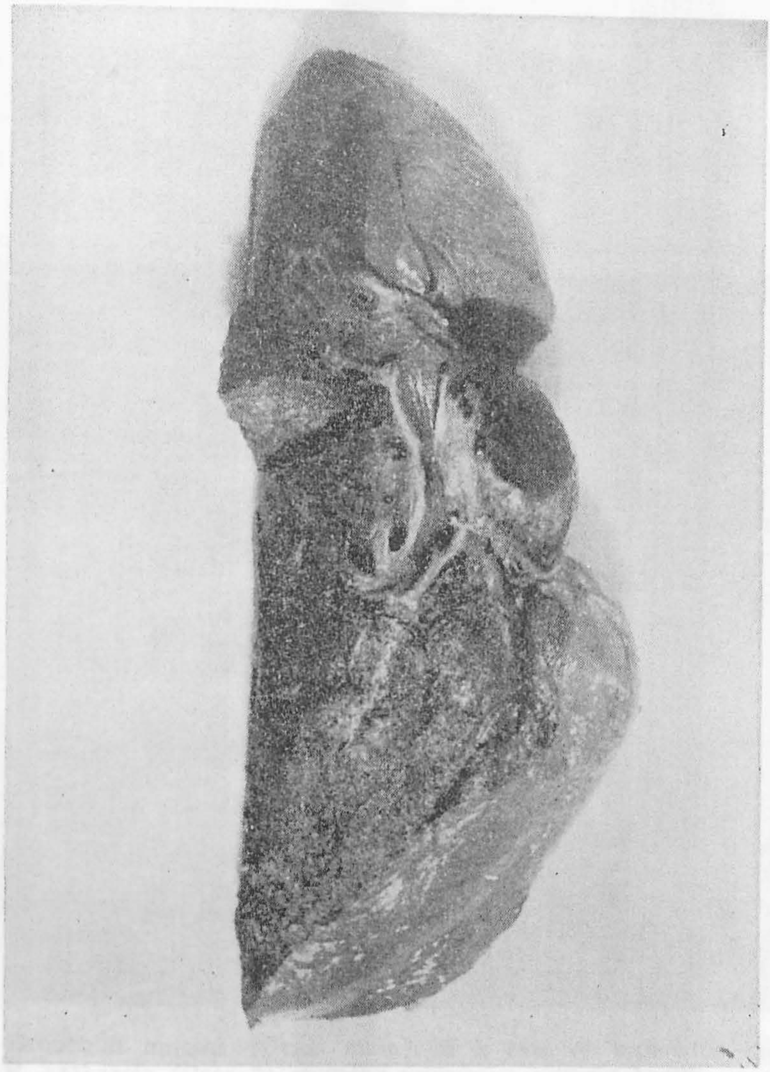


Fig. 14. Cut surface of the left lung: Hemorrhagic lymphadenitis in hilar region due to infection by *B. anthracis* (Case 3A).

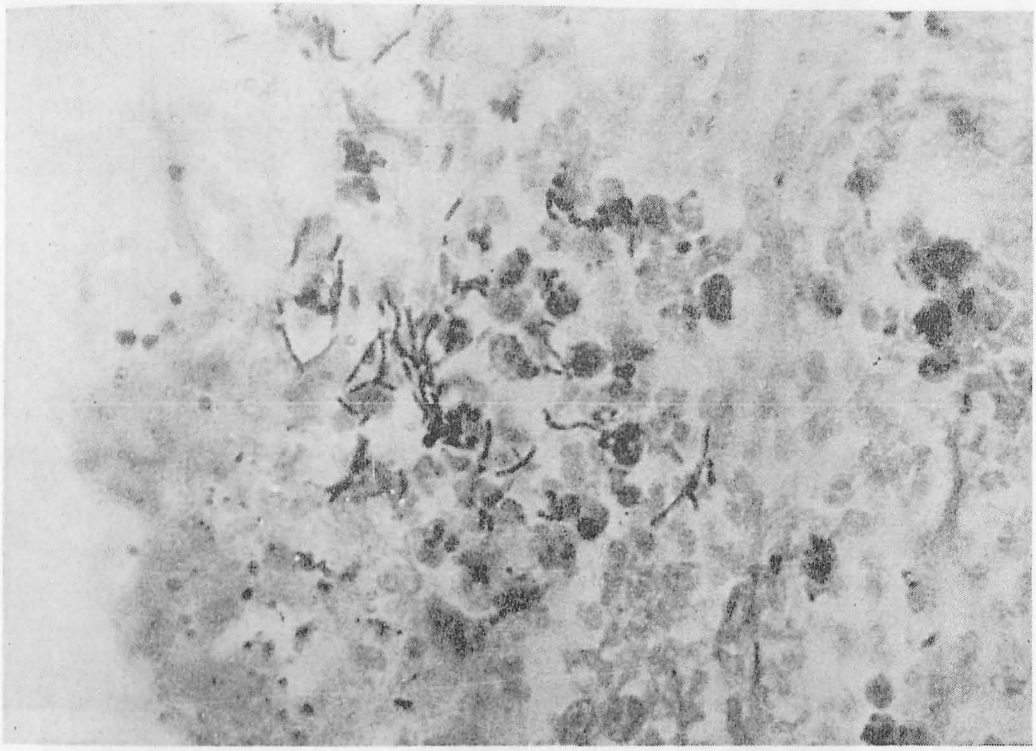


Fig. 15. Bronchial mucosa (Gram stain) of a case of bronchitis due to *B. anthracis* (Case 2) showing numerous anthrax bacilli.

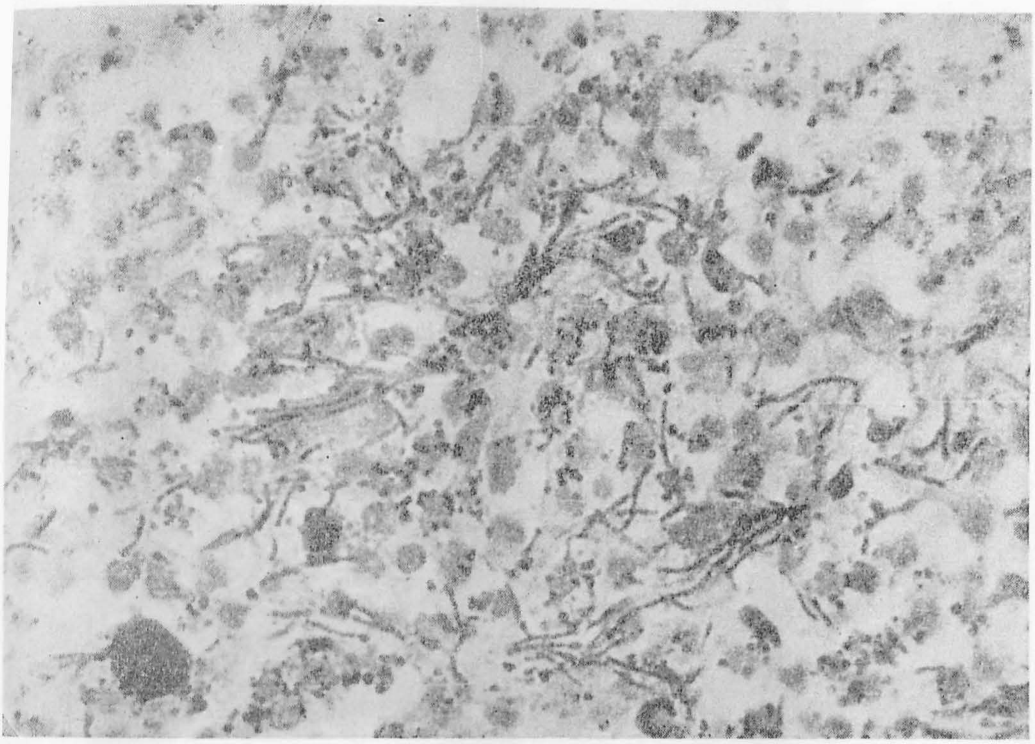


Fig. 16. Purulent and hemorrhagic lymphadenitis of the hilar lymph node due to *B. anthracis* (Gram stain) showing large numbers of anthrax bacilli (Case 2).

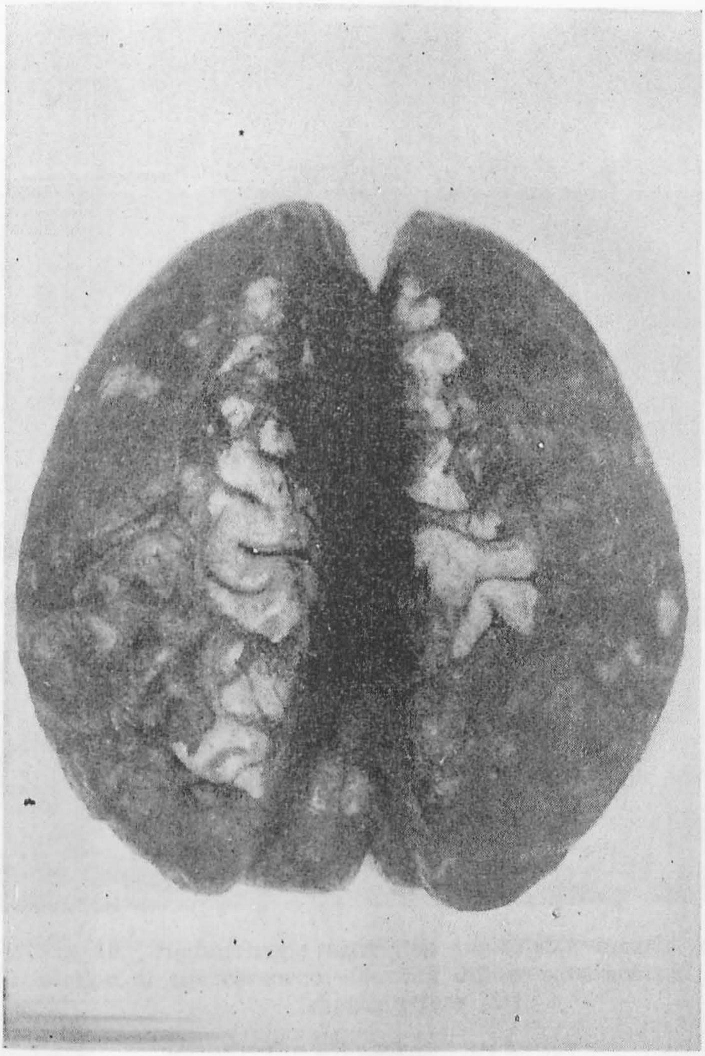


Fig. 17. Hemorrhagic meningitis due to *B. anthracis*. The cerebrum shows extensive and diffuse hemorrhages in the leptomeninges (Case 3A).

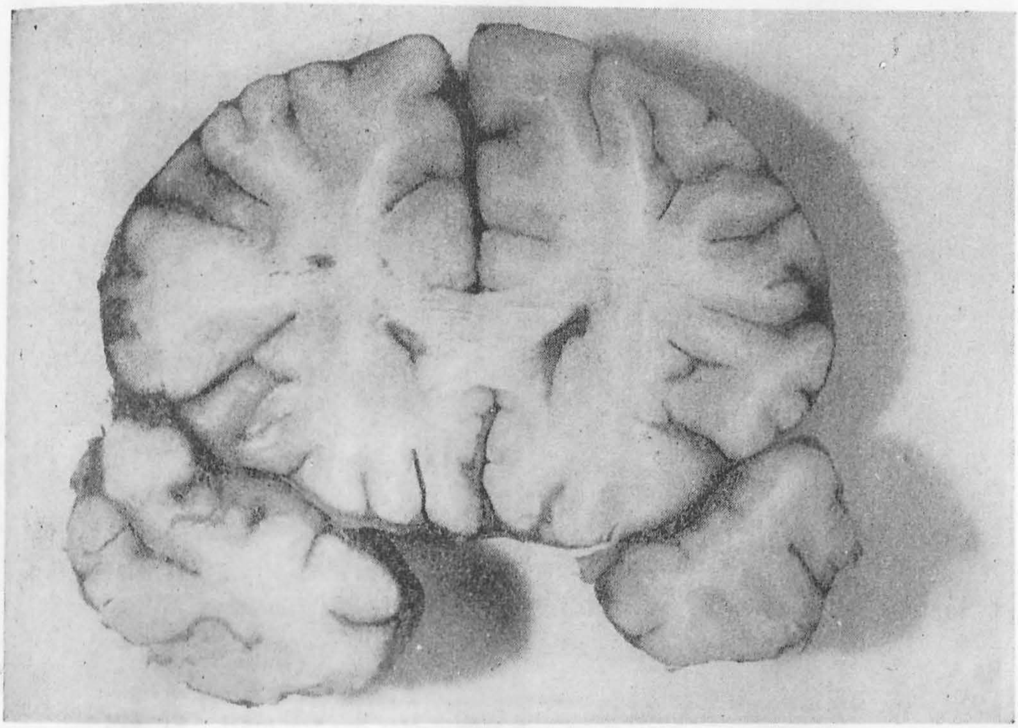


Fig. 18. Hemorrhagic meningitis due to *B. anthracis.* Coronal section of the cerebrum showing diffuse subarachnoid hemorrhages (Case 3B).

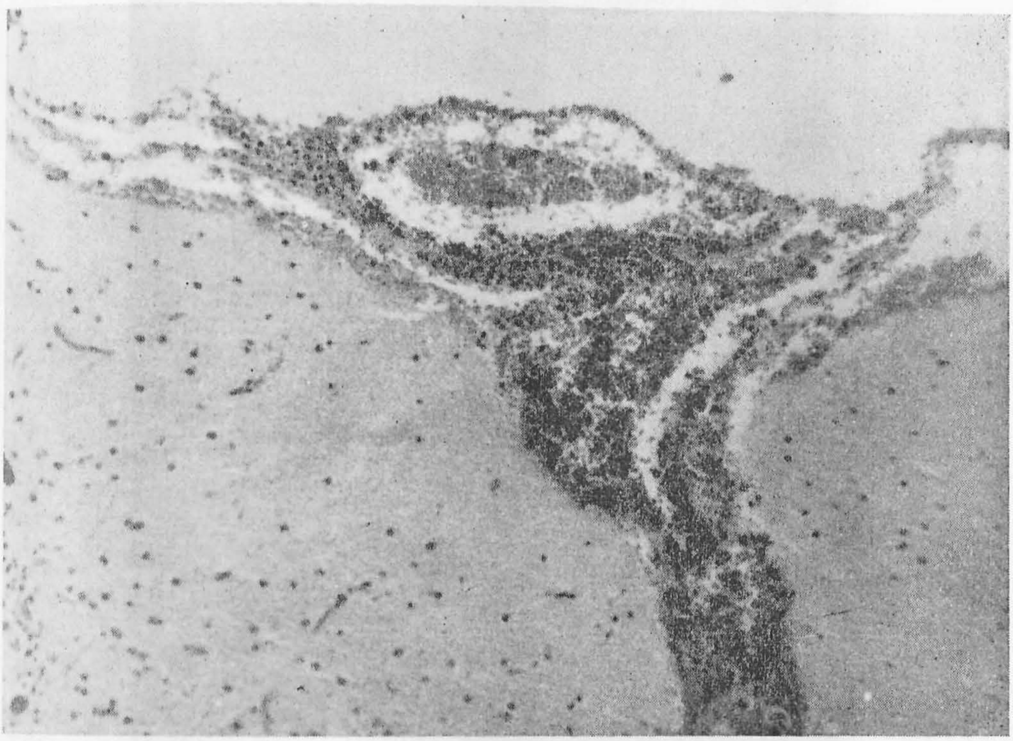


Fig. 19. Hemorrhage meningitis due to *B. anthracis*. Besides diffuse hemorrhage, there is also inflammatory cellular infiltration in the leptomeninges (Case 2).

Fig. 20. Hemorrhagic meningitis due to *B. anthracis* (Gram stain). Large numbers of Gram-positive anthrax bacilli in the lepto-meninges (Case 2).

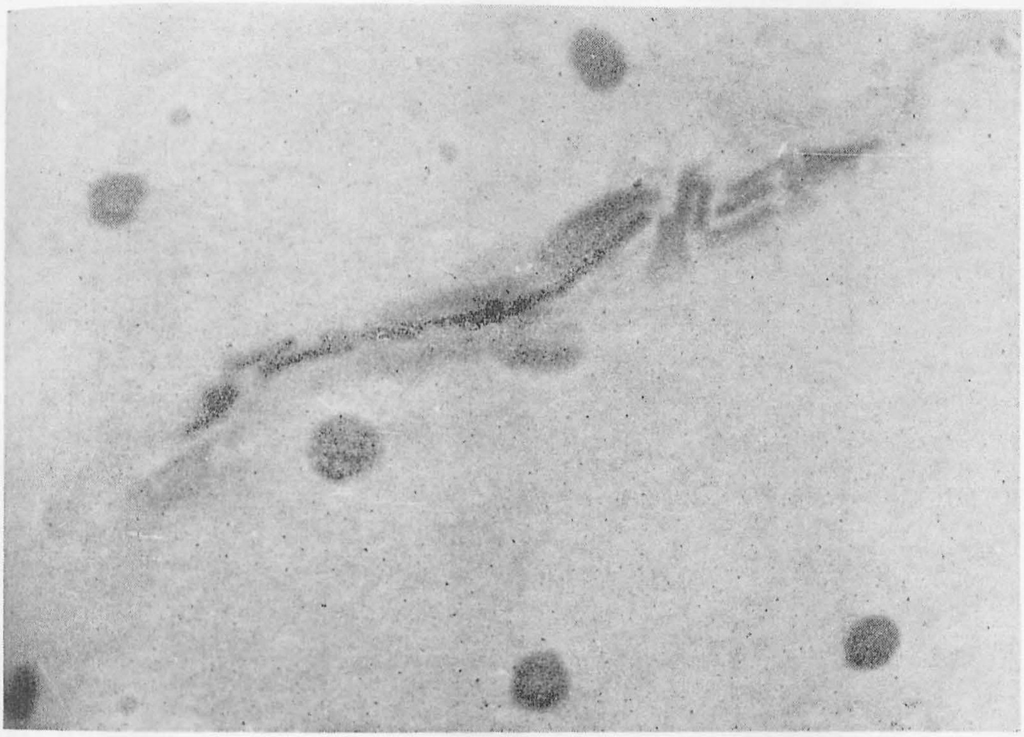


Fig. 21. A small blood vessel in the brain containing *B. anthracis* (Gram stain) (Case 3B).

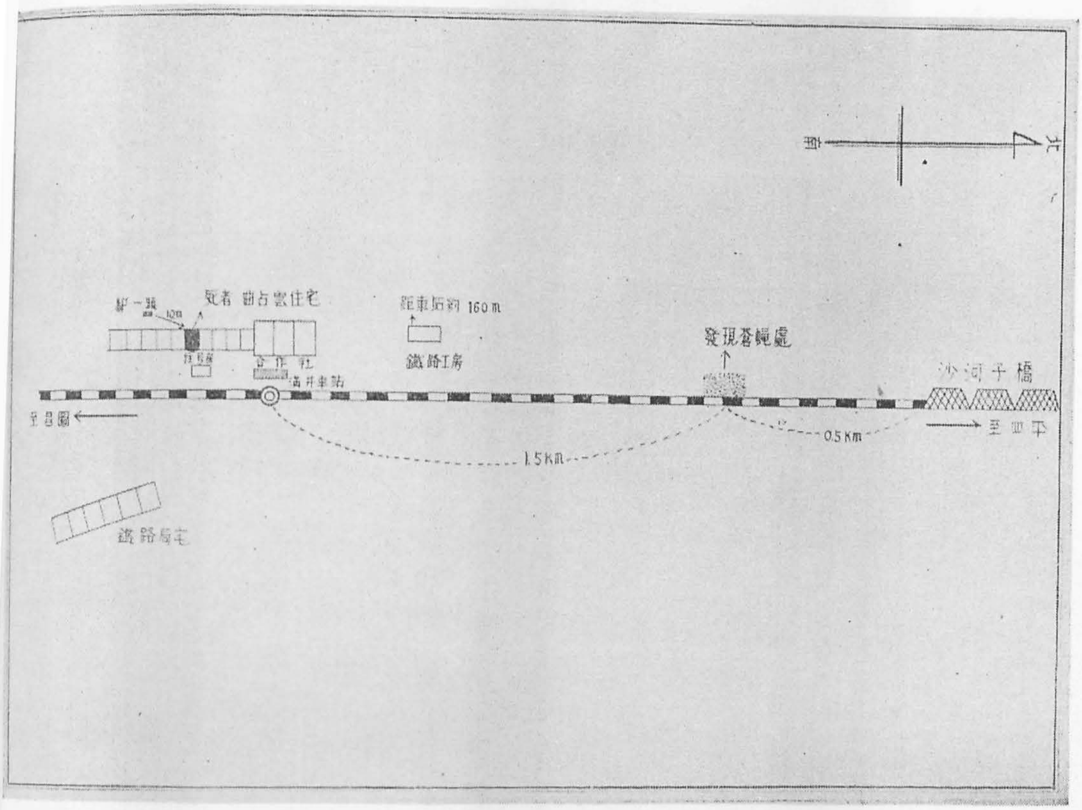
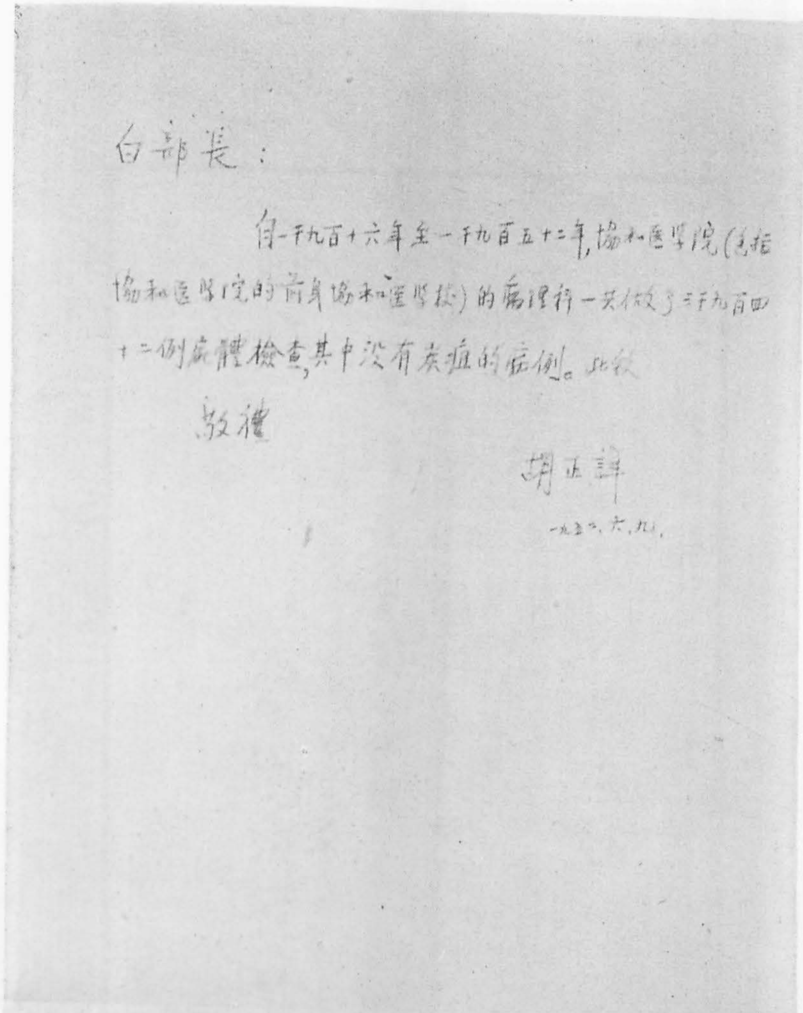


Fig. 22. Plan of Man-Ching Railway Station and its neighbourhood.



白部長：

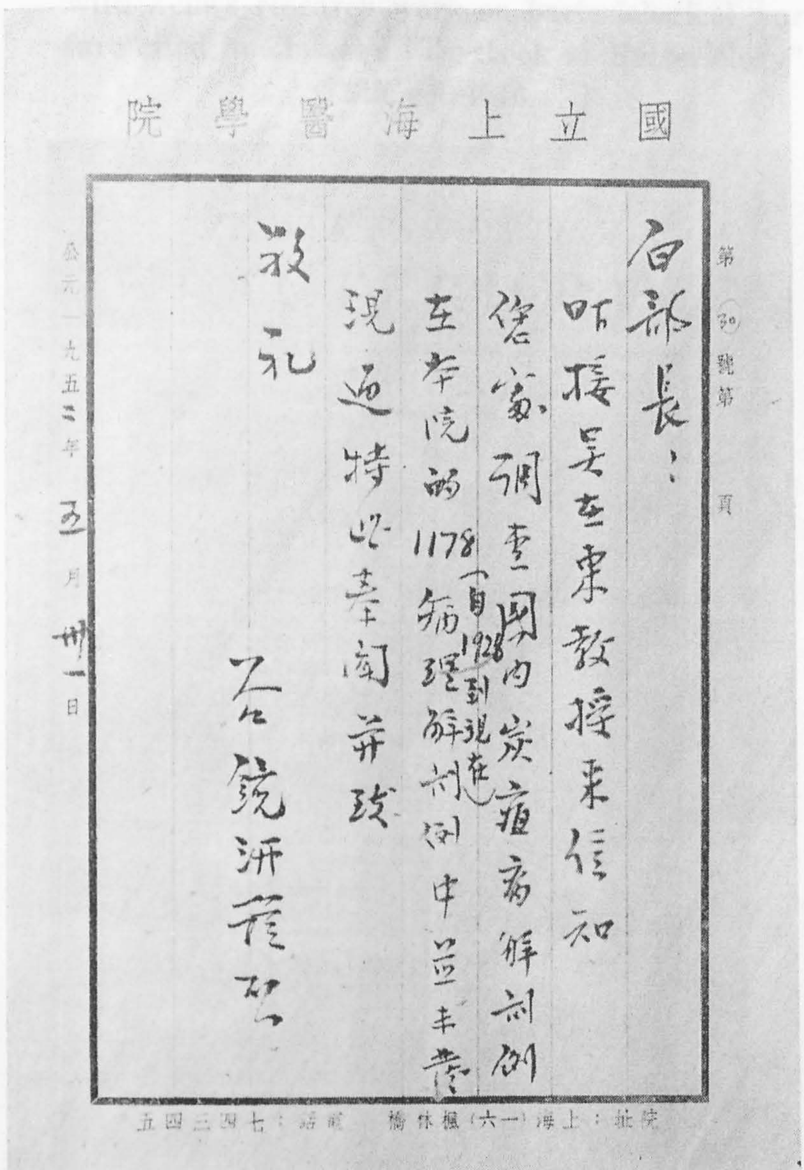
自一千九百十六年至一千九百五十二年，協和醫學院（是指協和醫學院的前身協和醫學校）的病理科一共做了三千九百四十二例屍體檢查，其中沒有炭疽的病例。此致

敬禮

胡正詳

一九五二、六、九。

Fig. 23. Statement by Prof. C.H. Hu that there has been no case of anthrax among 3942 autopsies since 1916 in the China Union Medical College (formerly P.U.M.C.).



國立上海醫學院

第 70 號 第 頁

白部長：

昨接吳在東教授來信知

您需調查國內炭疽病解剖例

在本院的1178（自1928到現在）病理解剖例中並未發

現過特此奉聞並致

敬禮

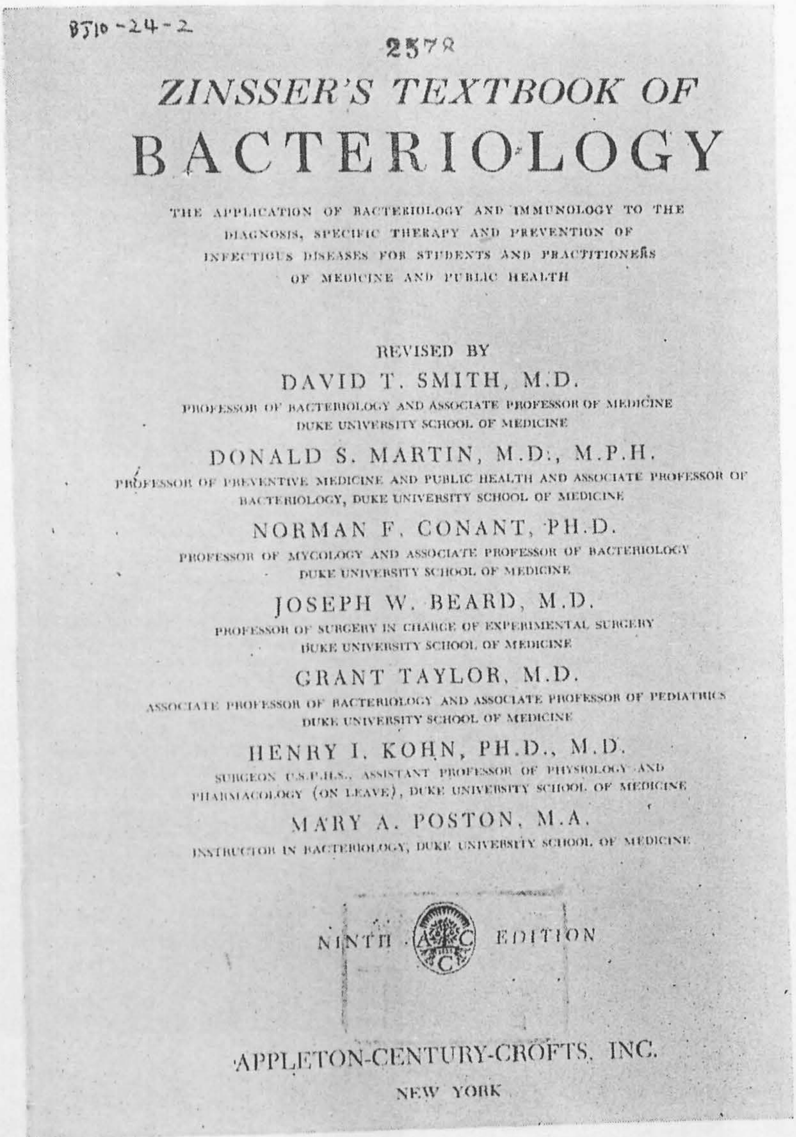
谷鏡汧謹啟

公元一九五二年五月卅一日

院址：上海（一六）楓林橋 電話：七四三四五

Fig. 24. Statement by Prof. C.Y. Ku that there has been no case of anthrax among 1178 autopsies since 1928 in the Shanghai Medical College.

The following Figs. (25a, 25b, 25c) are concerned with Zelle's research work on bacteriological warfare cited in Zinsser's "Textbook of Bacteriology", 9th. ed., 1946.



B510-24-2

2578

ZINSSER'S TEXTBOOK OF

BACTERIOLOGY

THE APPLICATION OF BACTERIOLOGY AND IMMUNOLOGY TO THE DIAGNOSIS, SPECIFIC THERAPY AND PREVENTION OF INFECTIOUS DISEASES FOR STUDENTS AND PRACTITIONERS OF MEDICINE AND PUBLIC HEALTH

REVISED BY

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Fig. 25 a.

phytic, sporulating bacilli; therefore, the test for pathogenicity is essential (Stein, 1911).

Resistance.—Because of its property of spore formation, the anthrax bacillus is extremely resistant to its chemical and physical environment. The vegetative forms themselves are no more resistant than most other nonsporulating bacteria, being destroyed by a temperature of 54° C. in thirty minutes. Anthrax spores may be kept in a dry state for many years without losing their viability (Surmont and Arnould, 1894). *While there are variations in the resistance of different strains of anthrax* spores, all races display an extremely high resistance to heat. Dry heat at 140° C. requires three hours to kill. Live steam at 100° C. kills them in five to ten minutes. Boiling destroys in about ten minutes. Destruction of anthrax spores in furs, hides, and brushes is difficult. Blue (1919) states that for brushes the best method is soaking for four hours in 10 per cent formalin solution at 110° F. Hair and bristles may be sterilized in the autoclave at 15 pounds for three hours, but this ruins many materials.

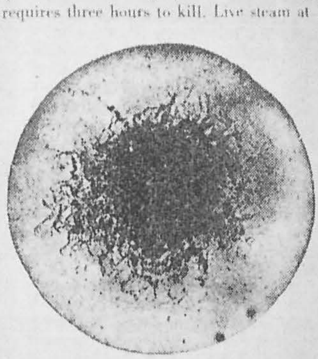

Fig. 114.—Anthrax Colony on Gelatin. (Guenther)

Spores may retain their viability after exposure to 5 per cent carbolic acid for forty days, or may be destroyed by the same solution in two days. Corrosive sublimate, 1:2000, kills most strains in forty *minutes*. Direct sunlight destroys anthrax spores within six to twelve hours.

Experimental anthrax infections in mice have been treated with sulfonamides, penicillin, and streptomycin. When used in maximum doses, sulfonamides saved 5 per cent, penicillin, 58 per cent, and streptomycin, 92 per cent of the *infected animals* (Miller *et al.*, 1946).

Variability.—Virulent anthrax bacilli produce rough (R) colonies. Less virulent or nonvirulent, smooth (S), mucoid (M), and gonidial (G) forms have been described (Gratia, 1921; Nungester, 1929). In connection with the work on bacterial warfare, Zelle and his associates (1946) selected variants that were especially adapted for invasion by the respiratory tract.

The attenuated strains which Pasteur obtained by cultivating the organism at a temperature of 42° to 43° C. were asporogenous. The essential change, however, was not in the loss of the ability to form spores, since some asporogenous races are highly pathogenic. Virulence depends upon the presence of a capsule or the ability of the organism to form one when introduced into the animal body. While separate races of anthrax bacilli may vary considerably in their degree of virulence, a single individual strain remains fairly constant in this respect if dried and preserved upon threads or kept in sealed tubes in a cold, dark place. Virulence is usually, but not always, increased by animal passage.

Fig. 25 b.

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Fig. 25 c.

The following Figs. (26a to 26k) show the reseach works of Zelle and his co-workers on the production of a variant of *B. anthracis* adapted for respiratory infection (J. Infect. Dis. 79, 1946).

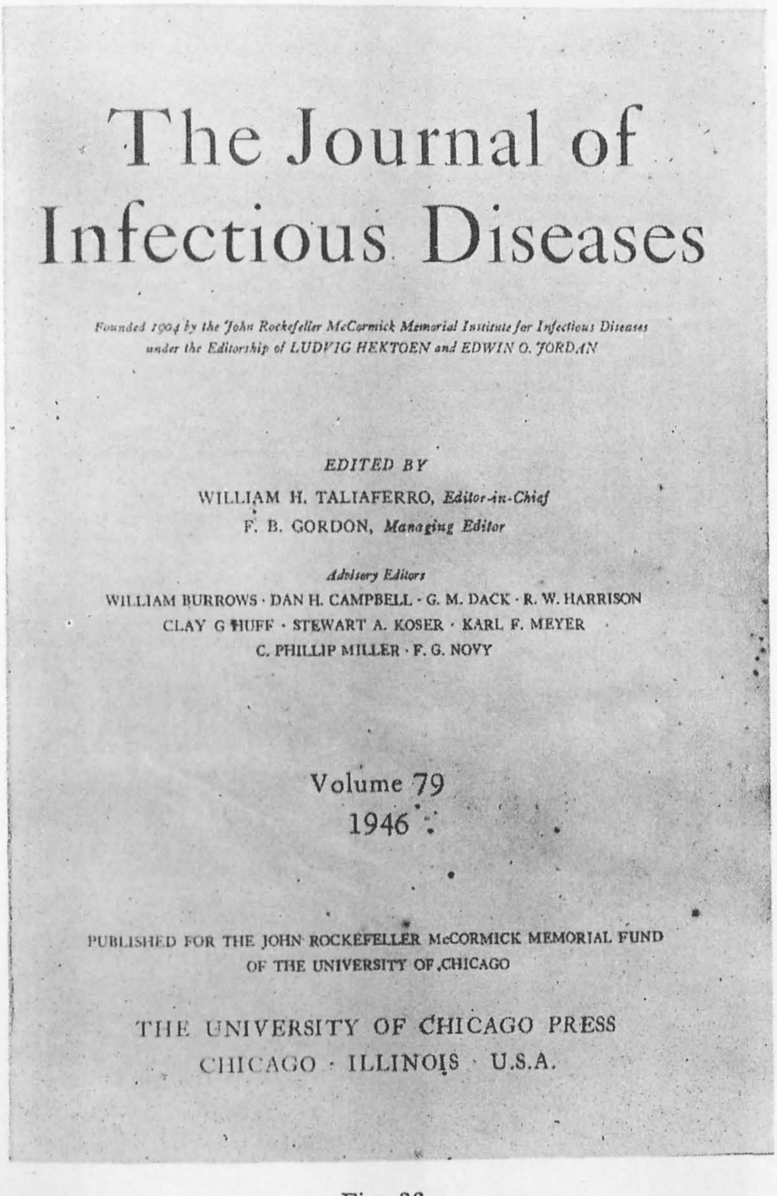

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Fig. 26 a.

RESPIRATORY PATHOGENICITY OF *BACILLUS ANTHRACIS* SPORES

I. METHODS OF STUDY AND OBSERVATIONS ON PATHOGENESIS*

GEORGE A. YOUNG, JR., (CAPT. VC, AUS), M. R. ZELLE, (LT.(J.G.) USNR), AND
RALPH E. LINCOLN, (LT. USNR)

INTRODUCTION

In general, variation in pathogenicity of any bacterial species arises from 3 sources: heredity, environment, and interactions between heredity and environment. Studies of some of the factors causing variation in respiratory pathogenicity of *Bacillus anthracis* spores will be presented in this and subsequent papers. The general methods of investigation used throughout the studies and observations on the pathogenesis of respiratory anthrax will be presented in the present paper.

A very complete treatise on anthrax has been presented by Sobernheim[1] which includes over 1,000 specific references as well as mention of a similar number of papers without specific reference. All aspects of the disease including the early and more recent work on respiratory anthrax are considered.

Buchner[2] found it possible to infect mice, guinea pigs, and rabbits by causing these animals to inhale anthrax spores. This was later substantiated by Enderlen[3] who was able to infect sheep in the same manner. This important early work showed that anthrax infection could be established through the normal lung epithelium. However, there was no adequate measurement of the dosage required to produce experimental respiratory infection.

Sanarelli,[4] in an attempt to explain spontaneous anthrax, produced experimental infections via the respiratory route both by inhalation and intranasal instillation. Between 50,000 and 100,000 spores were required to infect rabbits by the latter method. Boquet and Saenz[5] later showed that infection of guinea pigs was possible by intranasal instillations of anthrax spores.

Also of interest in the study of respiratory anthrax is a series of papers by Velu et al.[6-9] These workers concluded that while it was difficult to infect experimental animals with spores alone, anthrax infection of the lung was easily established after the lung had been damaged by inhalation of chlorine gas.

The results in the present paper agree for the most part with those of the earlier workers. However, the method of exposure employed, which permits reasonably accurate measurement of respiratory dosage, and the statistical analysis of the data make it possible to compare the respiratory pathogenicity of different cultures and the suscepti-

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Received for publication June 15, 1946.

* Work carried out at Camp Detrick, Frederick, Maryland from December 1943 through August 1945.

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Fig. 26 b.

portion of cloud equivalent to that introduced.

More specifically, a 24×24×36 inch rectangular autoclave without a jacket was equipped with 3 pyrex glass observation windows (fig. 1). One of these windows (7) was covered by a flood lamp

spore concentration (4), (5), (6). Other pipe connections were those which were standard on most commercial autoclaves.

The spores were made airborne by means of 2 nebulizers in parallel near the front of the chamber (12). These

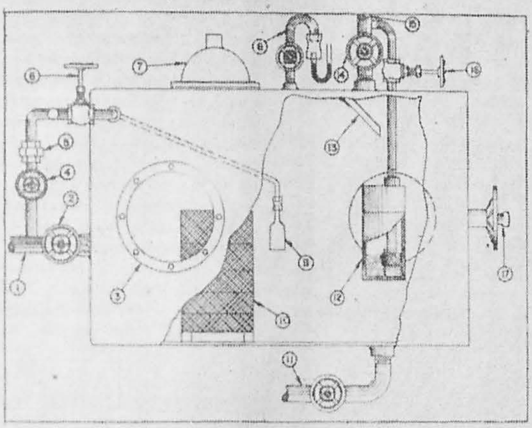

FIG. 1.—Respiratory exposure chamber.

(1) Vacuum exhaust line.
(2) Control valve for vacuum exhaust.
(3) Observation window.
(4) Valve on sample line.
(5) Union for standard orifice plate.
(6) Valve on sample line.
(7) Flood lamp.
(8) Mercury manometer assembly.
(9) Cotton sampler.
(10) Wire mesh animal holder (16 compartments).
(11) Drain line.
(12) Nebulizer (one of pair).
(13) Baffle plate.
(14) Valve on compressed air line.
(15) Combination compressed air and steam line.
(16) Control valve for nebulizers.
(17) Radial lock for chamber door.

to illuminate the chamber interior. The other 2 (3) were used for observation. Other modifications were openings for pipe lines into the chamber. One of these was an air line to the nebulizers (15). Another was a line to a mercury manometer for controlling the pressure of the chamber (8). The third opening was for a vacuum line used to withdraw a sample of the cloud for the determination of the

nebulizers were made from stainless steel with a removable cup in which the spore suspensions were placed. Control of the concentration of spores nebulized into the chamber was obtained by keeping the air pressure in the nebulizer line constant and varying the concentration of the spore suspension. As the size of the air openings was fixed and the pressure constant, the rate of flow through

Fig. 26 c.

SUMMARY

An exposure method for producing experimental respiratory anthrax in several species of animals is described. This exposure technic plus statistical treatment of the resulting data makes possible quantitative comparison of the relative pathogenicity of different anthrax spore suspensions and of the comparative susceptibility of animal species.

A description of the histopathology of respiratory anthrax is given. From the essentially negative pathological findings, it is pointed out that anthrax produced by inhalation of anthrax spores is not a specific disease of the lung but rather a systemic disease. There is little or no reaction of lung tissue to anthrax spores in experimental animals exposed to spore clouds when observed until a few hours before death. Terminal bacillemia is accompanied by minimal changes only. These are as follows: Active hyperemia with some hemorrhage caused by increased capillary permeability; presence of bacilli in all vessels and to some extent in the alveolar walls. The original site of invasion of the spores could not be determined histologically.

Invasion of the host by inhaled anthrax spores is shown to occur through the lymphatic system.

Quantitative studies made on the organisms present in the lungs and peribronchial lymph nodes indicate that highly pathogenic spores are more invasive than spores of moderate respiratory pathogenicity in that they are present in greater numbers in the peribronchial lymph nodes and are also more able to persist in the lung itself.

Acknowledgment: The authors wish to express their appreciation for the assistance of A. J. Moses in much of this work.

Fig. 26 d.

RESPIRATORY PATHOGENICITY OF *BACILLUS ANTHRACIS* SPORES

II. GENETIC VARIATION IN RESPIRATORY PATHOGENICITY AND INVASIVENESS OF COLONIAL VARIANTS OF *B. ANTHRACIS*

M. R. ZELLE (LT.(J.G.) USNR), RALPH E. LINCOLN (LT. USNR), AND GEORGE A. YOUNG, JR. (CAPT. VC, AUS)

INTRODUCTION

Variation in morphological and physiological characteristics of bacteria is a common phenomenon. Reviews have been published by Hadley.[1,2] In general, a correlation has been observed between virulence and colony morphology with the smooth colony types exhibiting the greater virulence. However, *Bacillus anthracis* is generally regarded as an exception in that the smooth variants of this species have been found to be less virulent than the normal rough forms. Nungester[3] has reviewed the earlier literature and has classified colonial variants of *B. anthracis* into some 7 categories. Nungester concludes that no or little correlation between colony type and virulence occurs in *B. anthracis* since he observed both virulent and avirulent cultures of the same colonial type. Stein,[4] although not making a point of it, studied cultures of differing pathogenicity but of the same colonial type. The present paper presents evidence bearing on the correlation between colony type and subcutaneous pathogenicity and reports studies of the respiratory pathogenicity and invasiveness of several colonial variants of *B. anthracis*.

MATERIALS AND METHODS

All cultures studied were derived from the Detrick 25 strain of *B. anthracis** and in all cases were prepared with single vegetative colonies of the desired type as described in the first paper of this series[4] unless otherwise indicated. The cultures were grown in the PPY medium described in the third paper of the series.[6] The composition of the medium is presented below.

1.0% pepticase
0.6% peptone (USP)
0.8% glucose
0.25% plasmolyzed yeast (solids)
0.03 M KH_2PO_4
0.03 M K_3HOP_4
0.00004 $FeSO_4 \cdot 7H_2O$
0.001 M $MnSO_4 \cdot 4H_2O$
0.0002 M $MgSO_4 \cdot 7H_2O$
0.0002 M $CaCl_2 \cdot 6H_2O$

The medium was sterilized at 120 C for 20 minutes, the glucose being sterilized separately and added aseptically to the rest of the medium. Spore suspensions were checked for genetic variation by observing upwards of 250 colonies upon smeared nutrient agar plates. All observations of colony morphology were made with a stereoscopic dissecting microscope at a magnification of 9× utilizing reflected light. The method of exposing animals to respiratory anthrax and methods of statistical treatment have been described in the first paper.[4] The measure of respiratory pathogenicity is defined as the number of spores per liter of cloud (multiplied by 10^{-6}) which will cause 50% mortality among animals exposed to the cloud for 5 minutes and is symbolized as LRE 50 or 50% lethal respiratory exposure. All respiratory tests were made on groups of 16 animals and mortalities recorded for a 7 day period.

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Work carried out at Camp Detrick, Frederick, Maryland from September, 1944, through August, 1945.

* Isolated by Dr. D. W. Henderson and Dr. C. E. Venzke following an extensive series of animal passages.

1. Hadley, Philip 1927, J. Infect. Dis. 40: 1.
2. Hadley, Philip 1937, J. Infect. Dis. 60: 129.
3. Nungester, W. J. 1929, J. Infect. Dis. 44: 73.
4. Stein, C. D. 1944, Am. J. Vet. Res. 5: 38.
5. Young, G. A., Jr., M. R. Zelle, and R. E. Lincoln 1946, J. Infect. Dis. 79: 233–246.
6. Lincoln, R. E., M. R. Zelle, C. I. Randles, J. L. Roberts, and G. A. Young, Jr. 1946, J. Infect. Dis. 79: 254–265.

Fig. 26 e.

as indicating that respiratory pathogenicity is influenced by numerous genes, some of which affect colony morphology while some do not. Hence, the correlation between colony morphology and respiratory pathogenicity is not perfect since the 2 characteristics may vary independently.

SUMMARY

1. Four colonial variants of *Bacillus anthracis* vary significantly in respiratory pathogenicity for guinea pigs and rats.

2. No significant differences between the 4 variant types were observed in subcutaneous virulence tests on guinea pigs and mice, but significant differences were observed in subcutaneous virulence for rats.

3. Significant differences were demonstrated in the ability of the 4 types to invade through the tissues of the lungs.

4. Fatal respiratory infections with *B. anthracis* spores appear to result from effective invasion by only a very few spores.

5. Significant differences in respiratory pathogenicity were observed between cultures of the same colony type. The magnitude of the differences was equal to that observed between variant types. Hence, it appears that while colony morphology and respiratory pathogenicity of *B. anthracis* are correlated to a certain extent, they may also vary independently.

Fig. 26 f.

RESPIRATORY PATHOGENICITY OF *BACILLUS ANTHRACIS* SPORES

III. CHANGES IN PATHOGENICITY DUE TO NUTRITIONAL MODIFICATIONS

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Environment may affect the pathogenicity of bacteria by (1) providing conditions under which variant types of cells selectively reproduce with consequent changes in the genetic constitution of the population, (2) by inducing temporary alterations of the protoplasm of the bacterial cell, or (3) by both. Most of the literature dealing with the effect of nutrition of bacteria on pathogenicity is concerned with changes that occur after colonial variation is obviously manifested or after serial transfer for many generations. Changes in pathogenicity after serial transfer are likely to be the result of changes in the genetic constitution of the culture since serial transfer provides ample opportunity for selection of mutant types of different pathogenicity which may or may not differ in colony morphology. For example, McNew[1] has shown that *Phytomonas stewartii* of low virulence became more virulent after growth in a synthetic medium containing inorganic nitrogen. However, he was able to mechanically separate cultures of high virulence from the original culture with low virulence. Thus, the increase in virulence probably was due only to intensive selection. Longley et al.[2] showed that cultivation of either *Phytomonas tumefaciens* or Rhizobia in mediums containing small concentrations of glycine or certain other amino acids resulted in a partial or complete loss of infective activity which was temporary after about 10 transfers and permanent after about 30 transfers. There are other reports in the literature of changes observed in the pathogenicity of bacterial cultures following cultivation upon artificial mediums for varying periods of time. There are also numerous experiments in which changes in pathogenicity were observed after serial passage of bacteria in both plant and animal hosts or by cultivation in the presence of antiseptics. In virtually all such experiments there has been questionable control of genetic changes in the population, so that it is not possible to definitely attribute such changes to temporary alterations in the protoplasm of individual cells or to selection of genetic types of differing pathogenicity. In instances where there was adequate genetic control, changes in virulence following serial host passage could be attributed to selection (Lincoln[3] for *Phytomonas stewartii* in maize and Zelle[4] for *Salmonella typhimurium* in mice). This paper considers the influence of the substrate upon the bacterial cell protoplasm as indicated by changes in pathogenicity of genetically controlled and homogeneous populations of *Bacillus anthracis*.

METHODS

The procedure for producing spores and the method of testing respiratory pathogenicity have been described in the first paper of this series.[5] The pathogenicity of spore suspensions is re-

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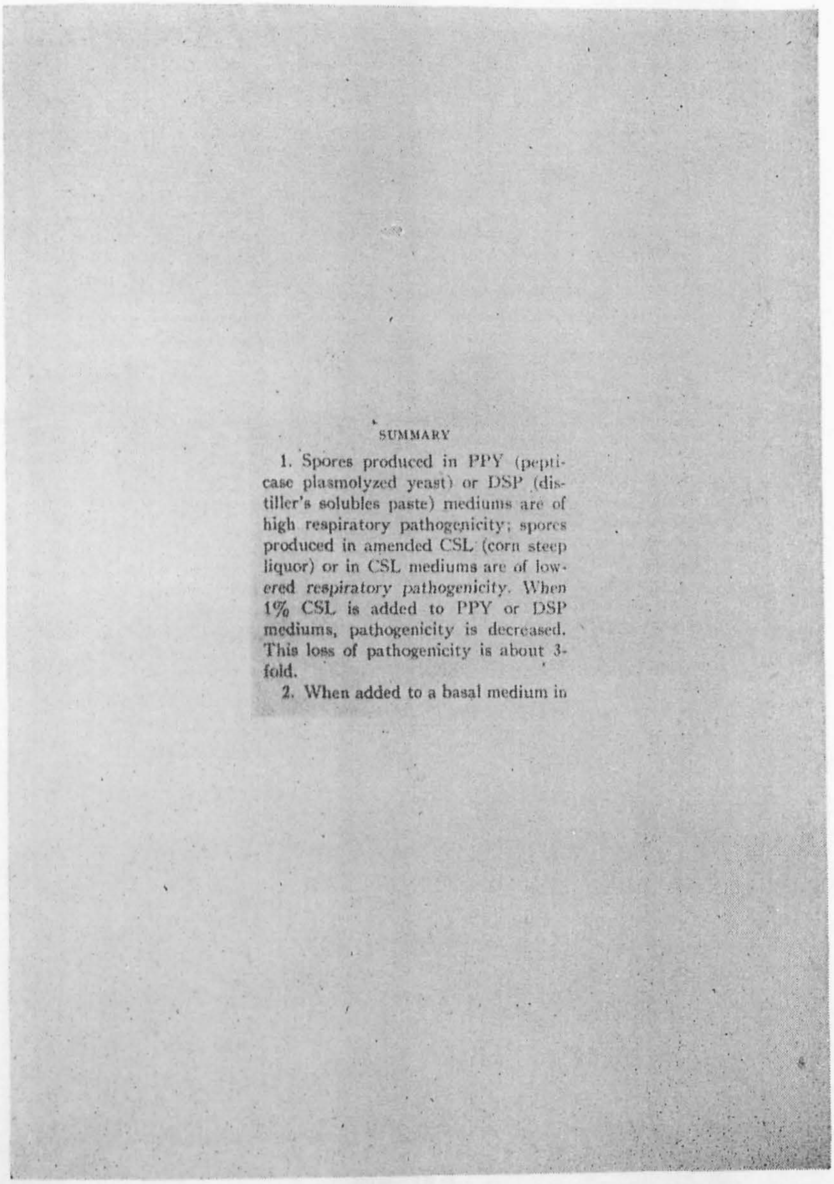
Work conducted at Camp Detrick, Frederick, Maryland, from December 1944 through August 1945.

1. McNew, G. L. 1938, Phytopath. 28: 769–786.
2. Longley, B. J., T. O. Berge, J. M. Van Lanen, and I. L. Baldwin 1937, (Abst.) J. Bact. 33: 29.
3. Lincoln, R. E. 1940, J. Agr. Research 60: 217.
4. Zelle, M. R. 1942, J. Infect. Dis. 71: 131–152.
5. Young, G. A., Jr., M. R. Zelle, and R. E. Lincoln 1946, J. Infect. Dis. 79: 233–246.

Fig. 26 g.



SUMMARY

1. Spores produced in PPY (pepticase plasmolyzed yeast) or DSP (distiller's solubles paste) mediums are of high respiratory pathogenicity; spores produced in amended CSL (corn steep liquor) or in CSL mediums are of lowered *respiratory pathogenicity*. When 1% CSL is added to PPY or DSP mediums, pathogenicity is decreased. This loss of pathogenicity is about 3-fold.

2. When added to a basal medium in

Fig. 26 h.

conjunction with CSL, no ingredient was found that modified the effect of CSL *on pathogenicity*. Included in those materials tested were distiller's solubles paste, Puerto Rico invert molasses, dried brewer's yeast, plasmolyzed yeast, "Marmite" yeast, pepticase, and various peptones.

3. The factor or factors in corn steep liquor causing decreased pathogenicity appear to be water dialyzable. The loss in pathogenicity is not related to the general growth conditions of the culture medium.

4. The change in pathogenicity occurs in less than 11–18 cell generations, is not accompanied by colonial variation, and is non-hereditary.

5. The subcutaneous pathogenicity of spores produced in CSL-free mediums is less than that of spores produced in CSL-containing mediums. However, spores produced in CSL-free mediums are more invasive in respiratory exposures, hence of higher respiratory pathogenicity than spores produced in CSL-containing mediums.

6. The addition of the readily fermentable carbon compounds, sucrose, glycerol, glucose, or potassium lactate to a medium in the absence of "salts" results in a 3-fold loss in pathogenicity. Addition of the non-fermented or slightly fermented carbohydrates, galactose, fructose, and lactose to a medium in which "salts" had been omitted results in about a 2-fold decrease in pathogenicity. The basal medium without "salts" or carbohydrates produces highly pathogenic spores.

7. In mediums containing glucose, $MnSO_4$ is necessary for high pathogenicity. $CaCl_2$, $FeSO_4$, $MgSO_4$, and $ZnSO_4$ had no influence on pathogenicity in the mediums used and did not interact with $MnSO_4$.

8. Corn steep liquor or salts produce their effect on pathogenicity during the growth of the cell and formation of the spore. The addition of these factors to spore suspensions produced in their absence does not alter pathogenicity significantly.

9. The significance of this non-genetic environmentally induced alteration in pathogenicity in relation to pathogenicity of bacterial cultures is discussed.

Fig. 26 i.

RESPIRATORY PATHOGENICITY OF *BACILLUS ANTHRACIS* SPORES

IV. CHEMICAL-BIOLOGICAL SYNERGISMS

GEORGE A. YOUNG, JR. (CAPT. VC, AUS) AND M. R. ZELLE, (LT.(J.G.) USNR)

The influence of a variety of chemical agents on the course of the disease anthrax has been previously reported. Most of these studies were made in an attempt to establish evidence of therapeutic value for the chemicals used in the treatment of animals infected with anthrax. However, there are several papers which show the variety of substances which will adversely affect the course of the disease. In this respect, Cadeac[1] ascertained that previously infected dogs died suddenly from anthrax following injections of as little as 0.0005 g of mercuric bichloride. Neri and Miceli[2] found that the natural resistance of rabbits to No. 1 and No. 2 spore vaccine was lowered by repeated sublethal injections of lead acetate. Likewise, Sanarelli[3] showed that the injection of arsenic, quinine, lactic acid, sodium nucleate, glucose, peptone, sodium hyposulfite, blood, distilled water, or cultures of living or dead colon bacilli was capable of lowering natural resistance so that fatal infections could be established with sublethal injections of anthrax spores. The adjuvants were used in concentrations small enough to cause no apparent damage to the host. Similarly, Hruska[4] demonstrated that the glucosides, digitonin and saponin, when injected in minimal concentrations lowered resistance sufficiently to allow infection with No. 2 Pasteur vaccine in previously immunized rabbits. More recently, Velu et al.[5] have shown that chlorine predisposes mice and guinea pigs to respiratory anthrax infection.

In this paper, experiments are described in which a variety of chemicals, largely salts of heavy metals, have been used to lower the natural resistance to anthrax infection established by respiratory exposure. The significance of the synergistic effects observed will be discussed in relation to the nature of natural resistance to respiratory infection with *B. anthracis* spores.

METHODS

The methods used in these studies were essentially the same as those employed previously.[6] The chemicals used were nebulized from varying concentrations of solution from 1 of the 2 nebulizers in the exposure chamber, the other being used to produce the cloud of anthrax spores. Chemical concentrations were determined by sampling known volumes of the cloud formed in the chamber by means of cotton samplers. Quantitative colorimetric analyses were made on the trapped chemicals. Since the cotton samplers also trapped the spores, quantitative plate counts were made from the dilute chemical solution to determine the concentration of the anthrax spores suspended in the chamber cloud.

As described in the first paper of the series,[6] respiratory exposure was measured in terms of RE which is the average number of spores (multiplied by 10^{-4}) suspended in a liter of cloud for a 5-minute exposure. The respiratory exposure or RE of the chemical agents is taken as the average

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Work carried out at Camp Detrick, Frederick, Maryland from April, 1944, through August, 1945.

1. Cadeac, M. 1901, J. Med. Vet. Zootech. 52: 710.
2. Neri, F., and A. Miceli 1939, Giorn di Batterio e Immun. 23: 186.
3. Sanarelli, G. 1925, Ann. Inst. Pasteur 39: 209.
4. Hruska, K. 1933-34, Zeitschr. f. Immun. Exp. Therap. 81-82: 367.
5. Velu, H., P. Soulie, and B. Bellocq 1941, Bull. Acad. Med. 125: 159.
6. Young, G. A., Jr., M. R. Zelle, and R. E. Lincoln 1946, J. Infect. Dis. 79: 233-255.

Fig. 26 j.

SUMMARY

Respiratory exposure to mixed aerosols of salts of heavy metals and *Bacillus anthracis* spores in concentrations which would have no lethal effect if used separately causes fatal anthrax infections in mice, guinea pigs, and rats. This relationship between the chemicals and anthrax spores is truly synergistic. A hypothesis is presented attributing the synergism to chemical inactivation of the enzyme systems, mainly those which are dependent upon the presence of free sulfhydryl groups for their activity.

It is pointed out that studies of the physiological effects of chemical compounds which exhibit synergistic relations with pathogenic organisms may be of value in furthering the understanding of the nature of natural resistance to specific diseases.

The authors wish to thank Charles Frazier for making the chemical determinations and for suggestions related to the chemical problems encountered.

Fig. 26 k.

Fig. 27. Witness Liu Chi-An.

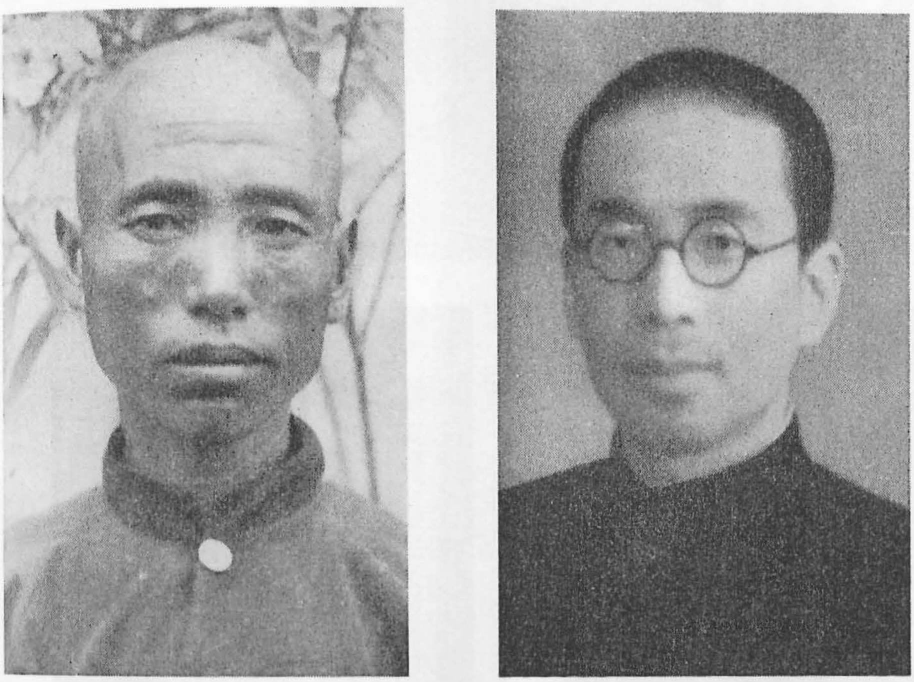


Fig. 28. Witnesses Wang Chiao-Ping (left), Sung Wei-I (right).

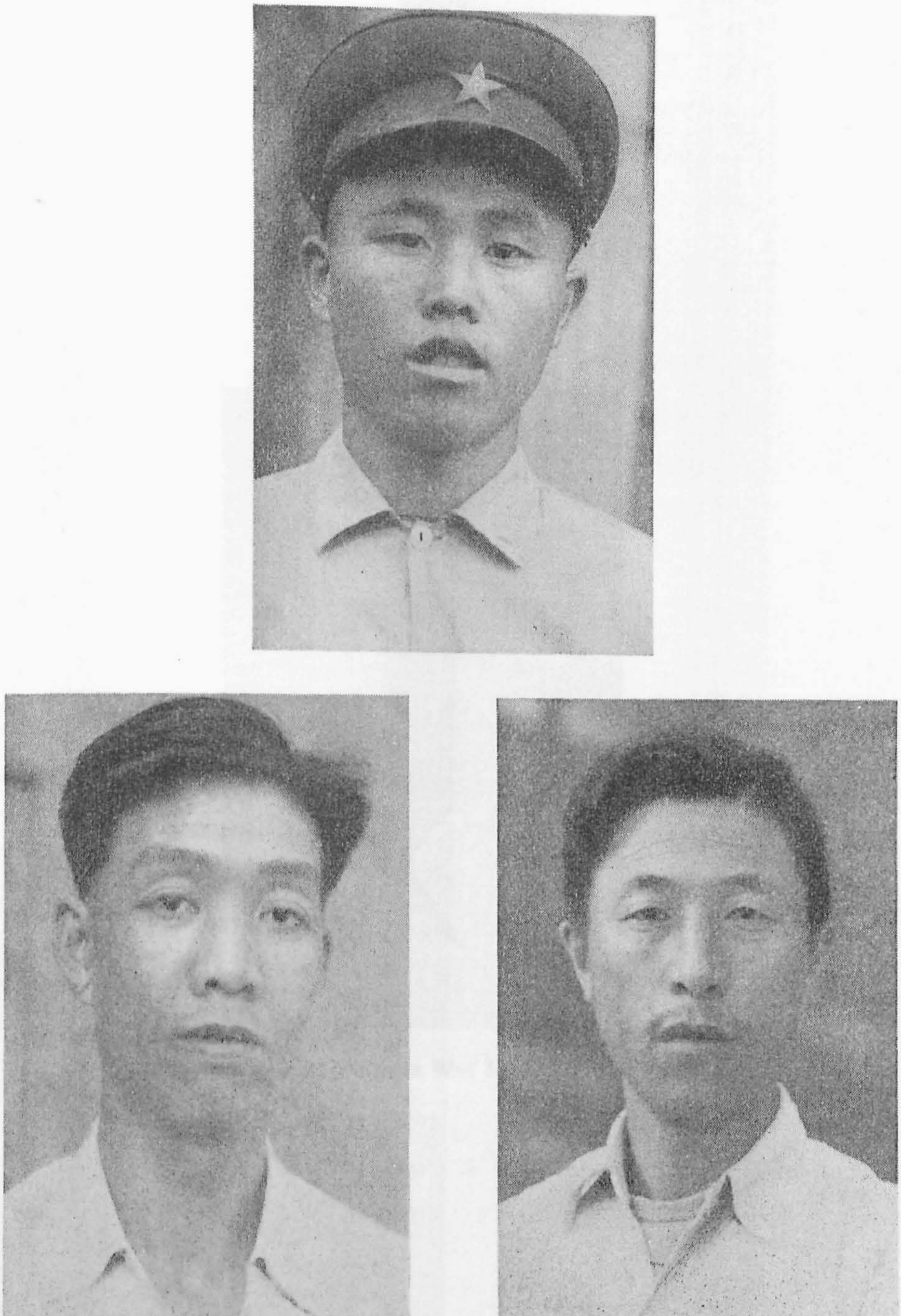


Fig. 29. Witnesses Liu Chung-Kuo (upper), Sung Teh-Yu (lower left), Pan An-Ying (lower right).

Fig. 30. Witness Wei Hung-Chin.

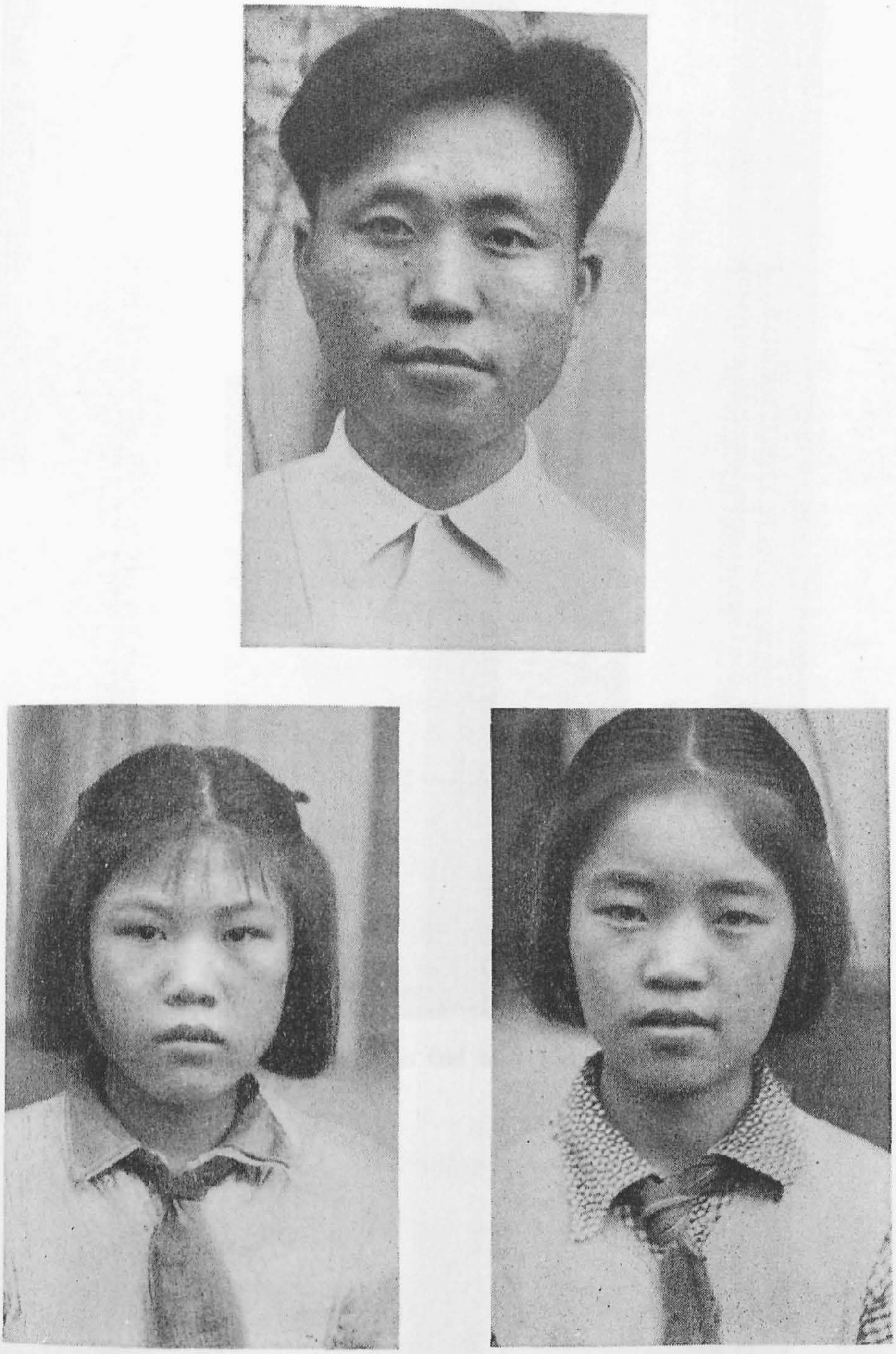


Fig. 31. Witnesses Ho Ming-Chia (upper), Liu Ching (lower left), Chao Yü-Chin (lower right).

Fig. 32. Witness Old Mrs. Liu.

APPENDIX BB

Hearings on the Incidents in Liaotung and Liaohsi Provinces Connected with the Dissemination of Anthrax Bacilli and Fatalities Arising Therefrom

A) Depositions of eye-witnesses, 22nd. July, 1952

First Case

	name	*age*	*occupation*
1)	Wang Yu-tsai	56	farmer
2)	Liu Chi-an	21	sanitary officer
3)	Liu Chung-kuo	27	railway platelayer
4)	Chang Yü-chia	28	medical student acting as bacteriological technician
5)	P'an An-ying	32	doctor
6)	Sung Tê-yu	30	pathologist
7)	Liu Chan-yuan	24	doctor, assistant to Dr. P'an.

1) Wang Yu-tsai found the flies in large numbers on the heaps of sand which he was engaged in carting, and recognised at once that this was abnormal for the season. (This was the case in which the document 00004 spoke of "flies gathering". Criticism of this in the west earlier in the year had asked how the flies could be gathering if they were supposed to be dispersing. It was established that this was purely a mistranslation from the Chinese text, the word should have been "gathered".)

(M) For him it was a sudden and inexplicable new phenomenon, he had never seen the like before.

(N) Assessed density 100-200 flies/sq. ft.; where less dense, still dozens. They could only creep about and seemed unable to fly.

2) Liu Chi-an took about 40 people with him to the spot to destroy the flies. Together they collected between 6,000 and 7,000 in an area about 4 x 5 metres; outside this region there were only a few.

(O) There were no dungheaps anywhere near from which the swarm might have come. It was a sandy heath.

3) Liu Chung-kuo found quantities of flies on and beside the railway line when walking with his foreman Ch'ü Chan-yün. They both thought that it was very odd to find so many flies in such cold weather, and he went back to the station to report, while Ch'ü remained and started to collect the flies, picking them up with his bare hands. When Liu returned with help, he noticed that whereas before the flies had been spread out along a length of about one rail length, now they had dispersed to about two rail lengths. Liu and his mates poured petrol on straw and burnt all the flies up. Afterwards the sanitary chap sprayed him and said it was all right for him to go home.

(O) The last train before they saw the flies had passed about an hour previously.

(M) They had had instructions to report any such phenomena to the stationmaster.

(N) The group who returned and finally destroyed the insects used forceps, improvised chopsticks, and masks. Ch'ü was the only one who used his bare hands, and he definitely did not wear a mask.

4) Chang Yü-chia, medical student, was acting as a bacteriological technician at Ssu-P'ing. He noticed that the abdomens of the flies which he received seemed very swollen. He crushed them with forceps and observed smears microscopically. Colonies on agar plates were typical of *B. anthracis;* they were quite large, with rugose surface like masses of hair. Hanging drop preparations were also made. Inoculation of the culture into a guinea-pig brought about its death in 40 hrs. Recultured in bouillon, a cloudy precipitate was seen, containing the bacilli. All results and material were sent on to Shenyang (Mukden) for confirmation.

(Z) Agar colonies further described.

(Mr. Chang said that he hoped very much that he would be able to return to his medical studies at Harbin Medical College and complete them. The Commission offered him their congratulations on an excellent piece of front-line scientific work, and wished him every success in his medical career.)

5) P'an An-ying was the doctor who attended Ch'ü in his last illness, the course of which he described.

(A) He knew of the connection which Ch'ü had had with the flies, and suspected that it might be anthrax due to them, but was not able to reach a definite diagnosis in time.

(Z) There was severe dyspnoea with rales when the last visit was made a couple of hours before death.

6) Sung Tê-yu described the results found at autopsy.

7) Liu Chan-yuan not called.

It was established from several witnesses that there was no sheep-raising anywhere around the district of Man-Ching and Ssu-P'ing.

Second Case

Wang Yu-lan, sister-in-law of the pedicab driver, Wang Tze-pin.

1) Wang Yü-lan said that her brother-in-law was single and gained his living in and around Shenyang (Mukden) by plying for hire as the driver of a pedicab (bicycle-rickshaw).

(A) Though she did not see him every day, she believed that he had engaged in the collection of insects when in one of the suburbs where a fare happened to have taken him. She heard that they were small ones. Did not know whether he wore a mask or used any other precautions.

Third case (a)

	name	*age*	*occupation*
1)	Wei Hung-ch'in	33	forester, State employee

1) Wei Hung-ch'in had gone to Harbin on duty when he received a telegram saying that his wife was dangerously ill. He was very surprised because she was usually in good health. When he got back to Anshan he found that she had been taken to the isolation hospital and had in fact died the night before. Friends who were looking after his children told him about her illness, which was similar to the other cases. She had certainly been out collecting beetles for several days previously. Whether she took full precautions, including a mask, he could not say. (She was

pregnant with a baby which she would have had if she had lived).

Third Case (b)

	name	*age*	*occupation*
1)	Lu Li-tsun	42	farmer at Liu-Erh-Pu
2)	Jen Wan-k'u	38	Home Guard sergeant
3)	Wang Hua-ming	15	schoolboy
4)	Li Lien-chung	32	village constable
5)	Wang Shao-chih	32	chairman of local mercantile and industrial association
6)	Mrs. Liu	57	old lady, landlady of the dead school-teacher
7)	Chao Yü-chin	14	school-girl
8)	Liu Ching	14	school-girl
9)	Wei Hua-nan	–	doctor
10)	Ho Ming-chia	25	husband of the dead school-teacher, himself teacher at a Teachers' Training College
11)	Lai Yü-chung	–	school-teacher, colleague of Mrs. Ho (Wang Shu-chih).

1) Lu Li-tsun heard the planes about six o'clock in the evening.

2) Jen Wan-k'u saw an object fall from one of the planes as stated in the Report.

(N) The object seemed to be about the size and shape of a large thermos flask, red in colour. As it fell, it turned flame-red or orange. The red colour could not have been the reflection of the sunset on a metallic object as the sun had already set.

(O) The noise of the explosion was very slight. The colour-change, if such there was, occurred at the same time.

(N) He smelt a disagreeable burning smell as if of burning animal skin or horn (or feathers), though he estimated the falling object as about 160 yards away from him. The explosive puff occurred when it was from 9 to 12 yds. above the ground, and 3 to 4 yds. above the house-roofs. There was no wind that evening. The main mass of insects was found underneath where the container had seemed to fall; this point was fixed by three different people who had seen it fall from different directions.

(M) He could not say whether the brightness of the object was like that of a paper lantern in which a light shines through a transparent exterior, but he did not remember thinking this at the time.

3) Wang Hua-ming when lying on the k'ang in his home, also saw the object falling in the twilight, and also smelt the smell. A first brief reconnaissance outside revealed nothing, but after he lit the lamp in the house, he noticed insects thickly gathered on the exterior of the window-panes. They were as big as a large rice-grain, and had a "hard shell" and two long feelers. Remembering what his schoolmaster had said about bacterial warfare, he assembled the family and neighbours, who collected as many as possible of the insects, using masks or handkerchiefs tied over the mouth.

(N) The object which he saw falling was certainly not like a lamp or paper lantern.

(It may be noted that the accounts of these two witnesses would not be incompatible with the delivery of two self-destructive containers, one of which had a mechanism which went off too soon and burnt its load of feathers, while the other duly delivered its load of beetles).

4) Li Lien-chung described the collection of the insects.

(M) He saw only one kind, namely beetles, just as the boy said.

5) Wang Shao-chih was waiting, on the evening of 27th, Mar. for a meeting to start, and went out to hurry up some of the members. While walking past a cooperative store he shone his flashlight on the wall, and saw many insects. He had never seen anything like so many in his life, nor had he seen any of that kind before. They had a "shell, six legs, and two wings". At the time of year insects were normally very scarce, for the snow was still largely unmelted. He guessed what the origin of these bettles was, and coming back to the meeting-place, mobilised the members to collect and destroy the insects.

(M) He recognised the beetle *Ptinus* from a photograph.

6) Mrs. Liu an old lady of nearly sixty, was the landlady of the school-teacher Wang Shu-chih, and looked after her child. Wang Shu-chih was very active in participating in hunts

for insects, and spent the better part of eight or nine days on it. After that she fell ill. She went with her husband to visit parents, but did not improve hereafter, and finally collapsed in the toilet at the school where she taught.

(A) Regarding the manner in which Wang Shu-chih and others collected the insects,she, herself, certainly had a mask and gloves, and they used twigs with sticky ends; but Wang Shu-chih was young and impetuous, and Mrs. Liu did not feel sure that she took all the precautions which she should have done, at all times.

(Z) The surviving child, a little girl of 2, was in perfect health and so plump as to be hard to carry.

7) Chao Yü-chin and

8) Liu Ching giving evidence together, said that they were in the class taught by Wang Shu-chih. At 9 a.m. on the 8th, April they went to the toilet and found Wang Shu-chih there in a state of collapse. She died 1½ hrs. later.

(M) The two girls had helped to collect insects, one of them actually with Wang Shu-chih. She thought that Wang Shu-chih generally wore a mask.

9) Wei Hua-nan when called as a doctor to Wang Shu-chih after her collapse, saw at once that she was already beyond aid. He had never seen a similar case in 20 years' experience. He rang up the Department of Health about it at 10 a.m., and the young woman died at 10½. Having been acquainted with her previously, he could say that she had a good physical inheritance, was strong and healthy, and in an excellent state of nutrition.

10) Ho Ming-Chia a teacher at a Teachers' Training College, was the husband of Wang Shu-chih. They had had an extremely happy married life for five years. Her health had always been excellent. Described what he knew of her illness. Whether she always wore a mask when collecting insects, he could not say.

11) Lai Yü-chung was a teacher in the same school as Wang Shu-chih, and a friend of hers. She was informed of her collapse by the girls immediately after their discovery. She was struck by the fact that the doctors said they had never seen a similar case.

(P) There were no lesions, so far as she knew, in the mouth of Wang Shu-chih, her teeth were good, and she had not bought a new toothbrush shortly before her illness.

(N) Regarding the precautions taken when insects were being collected, she had actually seen Wang Shu-chih working without a mask. She herself had not gone far afield for insects, and had always worn a mask. Other friends practically always wore them, and considered it rather risky on the part of Wang Shu-chih not to do so.

(O) Everyone in and around the school was a bit scared at these events.

(The Commission did not close this session without offering its deepest sympathy to the bereaved).

Fourth Case

	name	*age*	*occupation*
1)	Wu Ching-ming	28	farmer and Constable of village
2)	Chiang Wên-ch'ang	22	farmer and Home Guard sergeant
3)	Wang Chiao-p'ing	43	farmer and Constable of village
4)	Sung Wei-i	–	pathologist

1) Wu Ching-ming, Constable of the village of Pei-Ching-Tzu, near the coast of Liaotung, said that the village people were holding a meeting after assembling to extinguish a straw fire caused by a child accidentally at one of the houses Three American planes suddenly passed over, flying very low and very fast; the people took cover. He could not be sure of the type. (Other sources of information show that they were F-86 jets). He saw one of the trailing ones throw something out. Some said it was a bomb but he thought it was falling too slowly for that. It seemed to have a bright metallic colour and appearance, though it was hard to be sure, as the sun was shining (it was about 11 a.m.). It descended toward the Luan-Shih Hills. Chiang Wen-ch'ang and other Home Guard members went off to look for it, while he (Wu) rang up the District Government. Near what must have been the point of impact Chiang found great quantities of feathers which seemed to be those of hens, ducks and geese. The whole population of some 300 went out and worked for two hours collecting them. He saw that some were kept for examination and not destroyed.

(N) The wind was from the northwest on the morning that the object was dropped. When the people got to the part of the hills where the feathers were, they found that the feathers were distributed over a triangular dispersal area, the height of the isosceles triangle measuring about three-quarters of a kilometer and the base rather less than half a kilometer. It was supposed that the apex of the triangle represented the point of impact, since the feathers were most thickly distributed there, thinning out towards the base of the triangle gradually. The long axis of the triangle was in the line of the wind, the feathers spreading south-eastwards. No fragments of any container could be found near the presumed point of impact.

No insects of any kind were seen among the feathers.

Masks (or handkerchiefs) and chopsticks, had been prepared beforehand, and were used. Among the feathers some lumps of cotton-wool were found (the witness was not familiar with this, but called it "balls like the cotton flower itself").

No remains of bird skeletons were found anywhere on the hills.

(A) No trace of container, reaffirmed. No smell. All the feathers were small, downy, and moist; not as if from adult birds.

(M) He thought he saw the (metallic) object burst when about 30 ft. above the ground, but could not be sure, as he was 1 km. away. The total volume of feathers collected was enough to fill 14 large lemonade bottles.

2) Chiang Wên-ch'ang agreed in all details with the facts stated by the previous eye-witness,

(M) but saw no explosion.

(O) As the first to reach the feathers, with three fellow-members of the Home Guard, he noted them carefully. They were quite conspicuous, because largely white. The wind was rolling them gently along, but dispersal was greatly inhibited because they kept on catching in grasses, twigs, and plants.

He confirmed the low height and great speed of the planes.

Snow was still lying in the valleys of the Luan Shih Hills, and no trees were out anywhere.

(Z) He did not touch any of the feathers, nor let anyone else do so. All were downy.

(O) No one in his village or any other Chinese village that he knew of ever used feathers for stuffing bed-mattresses or cushions. Any such things that they had were stuffed with cereal husks such as millet. They were not accustomed to soft cushions or beds.

3) Wang Chiao-p'ing, Constable of East Shuang-Shan village, knew the dead farmer T'ien Ch'eng-ho well. He generally had good health. When he heard what had happened he (Wang) was therefore very surprised, and went to enquire about it from Mrs. T'ien. Four days before his death T'ien had been in normal health, and had gone to his fields to manure them. These fields lay about a km. south of East Shuang-Shan village, and therefore not far from the northern end of the base of the triangular dispersal area. Seeing a few feathers, T'ien had picked them up and handled them, as something rather unusual, but then remembered that they might be dangerous and let them lie. Two days later he fell acutely ill. After his death others went and found the feathers just in the location he had mentioned, and burnt them.

(A) T'ien had been warned of the danger, but forgot, and picked the feathers up out of curiosity.

(P) The dead farmer always shaved at home.

4) Sung Wei-i described the course of the disease which he, as physician, had followed. It was clinically identical with the other cases. The autopsy, which he described, was concordant with all the other pathological evidence. His findings of anthrax bacilli were confirmed by the bacteriological specialists of National Medical College, Shenyang (Mukden).

(M) The Chinese peasant does not generally carry a handkerchief.

[The Commission did not close this session without offering its deepest sympathy to the bereaved].

B) **Questions Addressed after the Depositions of the Scientific Specialists (qualifications in App. TT).**

1) Prof. Lu Pao-ling (entomologist)

(N) The beetle *Ptinus fur* is a pest of stored grain, leather, etc. It ought to occur only in granaries, museums, and places where dried stuffs are stored. Yet here it appeared in large numbers in the open air. Moreover, it is a nocturnal animal, yet at Liaoyang it made its appearance in the daytime. Furthermore, subsequent efforts to discover individuals of this species in granaries and other places where it would be likely to be found, in the neighbourhood, completely failed. The whole phenomenon is therefore oecologically very peculiar.

No figures could be obtained as to swarm density, but it was certainly considerable. The appearance of the beetle showed no seasonal abnormality.

In size it is 3.4 – 4.4 mm. long.

The species is widely found in China, but it is nowhere a common insect. No previous records of any similar swarm of this insect are to be found.

2) Dr. Chêng Kêng (bacteriologist)

(Z) Emphasis is to be placed on the fact that whereas strains of anthrax bacilli isolated from various natural places show marked differences in the fermentation tests, especially with regard to behaviour towards maltose and salicin; in the present case every one of the suspected objects tested (flies, beetles, and feathers) was found although collected from different places, to be carrying bacilli with the same fermentation charactenstics. This is a most unusual occurrence.

3) Dr. Pai Hsi-ch'ing (pathologist and Vice-Minister of Health, Northeastern Region).

(A) All cadavers of anthrax victims were cremated, although this is very contrary to traditional Chinese custom. Relations gave consent at the special request of the government. All possible additional precautions were taken to guard against infection.

(N) As regards anthrax among workers in the famous Chinese pig bristle industry, there had been no cases for a number

of years, a fact which was thought due to the widespread inoculation of the animals. So far, anthrax vaccine had not been available for man, but it might well be that it would be desirable to institute further researches on it immediately.

4) Dr. Fang Kang (bacteriologist, Central Research Institute of Health, Peking) (information received later).

Although in general opportunity did not permit of quantitative work on the various kinds of insects which were suspected of having been infected artificially, a rough estimation was carried out on the *Ptinus* beetles from the present series of incidents.

Six specimens of the beetle were ground up in 5 ml. of physiological saline and an inoculum of 0.004 ml. (one loopful) was transferred to each of several vessels of nutrient medium, with the aid of a loop of 3 mm. diam. There resulted from 15 – 20 colonies of anthrax bacilli in each case, from which it was possible to calculate that each insect had carried between 3,000 and 4,000 spores or bacilli.

C) Visit to the Pathological Laboratories of the National Medical College, Shenyang (Mukden).

Prof. Dr. Li P'ei-lin (pathologist) demonstrated slides showing:

(a) haemorrhages in sub-arachnoidal spaces
(b) anthrax bacilli in and around meningeal blood-vessels
(c) acute perilymphadenitis and peribronchitis
(d) anthrax bacilli in hilum lymph gland
(e) anthrax bacilli in mucosa of small intestine
(f) necrotic foci of colon with anthrax bacilli
(g) pneumonic lung tissue
(h) anthrax bacilli filling up a capillary in brain substance

On behalf of Prof. Lu Pao-ling specimens of the three arthropods concerned: (a) *Musca vicina*
(b) *Tarentula* sp.
(c) *Ptinus fur* were demonstrated.

It was particularly noted that the elytra of this beetle were exceptionally abundantly covered with chitinous bristles, which on breaking off could readily enter human respiratory passages, where they would act as inoculation needles.

D) **Summary of Data on Selected Cases of Anthrax Victims.**

Date of Death	Case No.	Name	Occupation	Mode of Infection
22/3/52	1	Ch'ü Chan-Yün	railwayman	flies (**Musca Vicina**)
24/3/52	2	Wang Tzu-Pin	pedicab driver	?
14/4/52	3a	Wei Liu-Shih	housewife	beetles (**Ptinus fur**)
8/4/52	3b	Wang Shu-Chih	school teacher	beetles (**Ptinus fur**)
18/4/52	4	T'ien Ch'êng-Ho	farmer	feathers

Note: In connection with the foregoing it is of interest to note that in the "Textbook of Medicine" of Cecil & Loeb, 1951, it is said of pulmonary anthrax (p. 243) that "death may occur within 18 – 48 hrs." It goes on: "Absence of the severe symptoms usually accompanying acute infections and the rapidity with which collapse sets in are characteristic features of this form of anthrax. Not infrequently the disease is suspected only because the patient's occupation subjects him to inhalation of dust from hairs soiled with spores."

The same work says of gastro-intestinal anthrax that the organisms are carried to the mouth from external lesions. Here again the infection may be symptomless, collapse, cyanosis and apoplectic death terminating the infectoin within 1 – 3 days. Haemorrhages in myocardium and brain are seen on autopsy.

Individual susceptibility to anthrax seems to vary considerably. The mortality rate may be as high as 40%, even if septicaemia and meningitis do not supervene. The organism is sensitive to certain sulpha-drugs and antibiotics, if the necessity of giving them could be recognised in time.

E) **Frequency of Occurrence of Cases of Anthrax according to Autopsy Records**

1) Shanghai Medical College Hospital, Shanghai
1928-1952 no. of autopsies 1178

2) China Union Medical College Hospital, Peking
1916-1952 no. of autopsies 3942

3) National Medical College, Shenyang (Mukden)
1940-1952 no. of autopsies 1093

In all these records, there was not one single case of acute pulmonary anthrax or acute haemorrhagic anthrax meningitis.

APPENDIX CC

Report on Two Cases of Cholera in Dai-Dong Goon Caused by Eating Raw Clams Contaminated with *V. cholerae* and Dropped by a U.S. Military Plane during the Night of May 16, 1952

(ISCK/1)

CONTENTS

I. REPORT ON FIELD ACTIVITIES OF EPIDEMIC PREVENTION CORPS IN DAI-DONG GOON

To the Minister of Health:

Herewith is a brief report on our field activities, during the period from the 19th to the 31st of May, 1952.

1. Having arrived at the spot, we quarantined the district and charged the local Home Guard with the responsibility of guarding the area and cutting off all communication with the outside.

2. The house of the patients and the neighbouring houses, the vomitus and stools of the patients were strictly disinfected, and sanitary measures were taken for Li Il-Nam who had been in contact with the patients. Measures also were taken to exterminate flies.

3. Li Il-Nam was isolated in a temporary isolation ward.

4. Epidemiological investigation revealed the following facts:

(a) The patient Cho Man-Pok, a merchant, male, aged 23, his wife, Li Yeung-Za, aged 22, and his brother-in-law, Li Il-Nam, aged 29, lived

in the same house. Li Il-Nam went to Pyongyang on May 15 and returning home in the evening of May 18, he found that his sister and brother-in-law were in dying condition.

(b) On the evening of May 17, 1952, Cho Man-Pok and Li Yeung-Za suddenly fell ill with vomiting and diarrhoea and they died some time between 8:30 and 11:00 p.m., May 18, 1952.

(c) Early in the morning of May 17, 1952, Li Yeung-Za had gone to a nearby hill to gather wild vegetables and there she found a package of clams wrapped in straw. She brought them home and together with her husband took them uncooked for breakfast. (These facts were stated by Li Il-Nam and Doctor Ha Too-Yeung.)

(d) Two broken clams, 7 pairs of shells and the remains of clams they had eaten were found in the patients' kitchen. The remains of clams and one broken clam were sent to the Laboratory of the Central Sanitary Epidemic Prevention Station (CSEPS) for examination.

(e) On May 19, the local Home Guard found four more straw packages of clams and an empty package on the same hill where Li Yeung-Za had gathered the clams and wild vegatables. Some of the clams were broken. Two of the unbroken ones were sent to the laboratory of CSEPS for examination, and all the remaining clams were burned and buried on the spot.

(f) The well where the patients obtained water for drinking was also used by their neighbours but none of them fell ill.

(g) On May 15, 1952, American planes bombed the water reservoir which is located not far from the village, and on the night of May 16, 1952, an American plane circled many times at low altitude over this region, according to the information obtained from the members of the local Home Guard.

(h) Results of bacteriological and chemical examinations:

1) *V. cholerae* was found in the patients' stools.
2) *V. cholerae* was found in the remains of clams eaten, in the clam found in the patients' kitchen and in the two clams found on the hill.
3) *V. cholerae* was found in the intestinal contents of the corpses.
4) No *V. cholerae* was found in the water sample taken from the well used by the patients' family and in the sample taken from the water reservoir near the village.

5) No *V. cholerae* was found in the flies caught from the houses and from the faecal depots of the quarantined district, and no cholera carrier was found among the villagers.

6) Chemical examinations of clams, stools of the patients, stomach contents, intestinal, and bladder contents, and the examination of the liver failed to reveal the presence of any kind of chemical poison.

5. Measures taken in the quarantined district:

(a) All the villagers were inspected daily and reinoculated against cholera.

(b) All the houses and courtyards, lavatory and refuses were disinfected daily.

(c) The villagers were forbidden to drink unboiled water, to eat raw food, to wash clothes near the well or to bathe in the brooks.

(d) Stools of the persons in contact with the patients and of the neighbours, water samples from the well from which the patients drew water for drinking, and water samples from the water reservoir were sent to the laboratory of CSEPS for examination.

(e) Flies in the quarantined district were killed by DDT dissolved in gasoline and some of them were sent to the CSEPS for examination.

6. Disposal of the corpses:

(a) Autopsy was done on the spot. The stomach with its contents, a piece of liver with gall-bladder, bladder with its contents, a segment of small intestine and a test-tube of peptone-water inoculated with the contents of the small intestine were sent to the laboratory of CSEPS for histological, bacteriological and chemical examinations.

(b) After autopsy the corpses and the house of the patients were burned.

7. No other new cases appeared between May 18th and 31st.

Conclusions:

1) The results of epidemiological, bacteriological, chemical, pathological and clinical examinations revealed that Cho Man-Pok and Li Yeung-Za were infected with and died of cholera, caused by eating raw clams contaminated with the cholera vibrio.

2) The appearance of five packages of clams on a hill with some clams broken can only be explained by the circumstance that the American plane flew over this district and dropped these clams.

By order of the Minister of Health, the quarantine was lifted on May 31, 1952, but medical inspections continued.

Reported by Kim Ho-Kyoum, M.D. (Signed),
Chief of the Epidemic Prevention Corps.

June 1, 1952.

RECORD OF WITNESS (1)

Statement of Li Il-Nam

Name: Li Il-Nam, Age: 29, Sex: male, Occupation: Merchant.
Address: Dai-dong Goon, Pyong-an-nam Do.
Family: Brother of Li Yeung-Za (age 22), and brother-in-law of Cho Man-Pok (age 23).

I lived with my brother-in-low, Cho Man-Pok, and his family in Tang-sang-I Li, Pyongyang before we moved to the present address on April the 29th. I went to Pyongyang on the 15th of May and returned in the evening of May the 18th. When I arrived at home, I called my brother-in-law by his name. There was no reply. I heard only a faint groaning. I was going to enter the house by the kitchen, but its entrance was stained with stools and vomitus. So I got in house through another entrance, and then I found my sister and brother-in-law lying on the bed. My sister was unconscious, and looked as if dead. When my brother-in-law perceived that somebody was in the house, he asked for drinking water. And soon he knew that I was back. I asked him what was the matter, and he managed to answer my question with a great effort as follows: His wife went to the near-by hill to gather wild vegatables in the morning of May the 17th, and there she found some clams. She brought the clams home and prepared them in raw condition for breakfast. The two ate the clams, and both fell ill with vomiting and diarrhoea in the evening of the same day. They could not prepare their supper. They were so sick that they were unable even to let their neighbours know about their illness. He had discomfort in the chest and cramps in the legs. While talking, he frequently fell unconscious and asked repeatedly for water to drink. I immediately sent a neighbour for a physician.

The doctor arrived about an hour later. In the meantime, the sister stopped breathing and appeared as if dead. My brother-in-law repeatedly complained of thirst and cramps in the legs. The doctor examined my sister first and declared that she was dead. He then examined my brother-in-law, and asked if he had eaten anything in the previous day. I told him what brother-in-law had just told me. After completing the physical examination, the doctor gave the patient

an injection. He warned me that this might be a cholera case, and that cholera was a most dreadful disease. And then he gave me disinfecting material to wash my hands, and he himself washed his hands too. Soon after the doctor had left, the patient complained of severe cramps and then died. Although he asked for drinking water several times before death, I did not dare to come near him for fear of the cholera.

A group of people soon appeared. They ordered me to stay in the room, saying they came from the Village People's Committee. I cried, screamed, and protested against shutting me up in the same room with the dead. They did not come into the room and passed the night outside the house. At about 5 in the morning, there came the Epidemic Prevention Corps unit, who disinfected the interior of the room, the vomitus and stools of the patient, and myself. They searched the room carefully as if looking for something. Prior to disinfection, they collected some stools in glass tubes. They took away the remaining clams from the kitchen. Later they put me in an isolated lodge on the hill, and forbade me to come out. Members of the Epidemic Prevention Corps brought food to me during the period of quarantine.

I have been inoculated 6 or 7 times this year, but I do not know what kind of injections they were.

Witness: Li Il-Nam (Signed)
June 1, 1952.

RECORD OF WITNESS (2)

Statement by Choi Eun-Ryang

Address: Dai-dong Goon, Pyong-an-nam Do.

Name: Choi Eun-Ryang. Sex: male, Age: 42, Occupation: peasant.

In the night of May 18, 1952, I was informed by Dr. Ha Too-Yeung of the fact that two persons were acutely ill after eating raw clams found on a hill, and one of them was already dead and the other in a critical condition. The doctor advised to quarantine the place and its vicinity. I at once mobilized the Village Home Guard and quarantined the district. Early the next morning the Home Guard conducted a thorough search of the locality, and found four more packages of clams and an empty package, some of the clams were broken. We were so afraid to touch the clams and packages of clams that none of us dared to go near them. When the Epidemic Prevention Corps unit arrived, we immediately informed them of this fact.

An American plane was droning extraordinarily low over this place at about 10 p.m., May 16, 1952, without strafing or bombing. I was the captain of the local Home Guard detachment at the time.

I confirm that these facts are true.

Witness: Choi Eun-Ryang (Signed)
May 19, 1952

II. CLINICAL HISTORY OF CHO MAN-POK

Attending physician: Ha Too-Yeung, M.D., private practitioner.
Date of first consultation: 9:30 p.m., May 18, 1952
Name of patient: Cho Man-Pok. Age: 23. Sex: male. Merchant.
Address: Dai-dong Goon, Pyong-an-nam Do.
Past and Family History: Unclear.
Chief complaints: Vomiting and diarrhoea.
Present illness:

According to the information obtained from his brother-in-law, the patient had eaten in the morning of May 17, 1952, the clams which his wife had gathered from a nearby hill. She found these clams early in the morning while she was searching for wild vegetables on the hill. In the evening he suddenly fell ill with diarrhoea and vomiting. He did not take supper and his condition became worse rapidly.

Physical examination revealed that the patient was in an acutely distressed condition. Pulse was imperceptible, heart sounds weakly audible, more than twenty beats per 10 seconds. Lips were markedly cyanotic and dry. Corneal reflex absent. Eyes and cheeks appeared sunken, zygomatic bones prominent. Patient was unconscious and unable to speak. Abdomen was markedly scaphoid in shape.

Vomitus and stools were seen in the room. The stools, which contained no blood, were gruel-like. There were no drugs or poisons to be found in the room.

Treatment: injected cardiotonicum.

Measures taken: I immediately informed the Village Epidemic Prevention Committee of this suspicious case of cholera and suggested quarantine.

The patient died at 11:00 p.m., May 18, 1952.

Reported by Dr. Ha Too-Yeung. (Signed)
May 19, 1952

III. REPORT OF PATHOLOGICAL EXAMINATION

Name of Patient: Cho Man-Pok. Sex: male. Age: 23
Address of Patient: Dai-dong Goon, Pyong-an-nam Do.
Date of Onset of Illness: In the evening, May 17, 1952.
Date of Death: Around 11 p.m. May 18, 1952.
Place of Death: Dai-dong Goon, Pyong-an-nam Do.
Date of Autopsy: 8 a.m., May 19, 1952.
Prosector: Chong Hi-Won.

Pathological Anatomical Diagnosis

1. Acute catarrhal, desquamative enteritis, (cholera).
2. Marked dehydration.
3. Petechial haemorrhage of epicardium and peritoneum.
4. Tuberculous primary complex, right upper lobe.

Macroscopic Examination

General appearance:

Body was 162 cm. in length, well developed but poorly nourished. Rigor mortis present in all joints and upper limbs slightly flexed. Livor mortis developed on dependent parts.

Skin: Dry and markedly wrinkled, especially that of the hands and feet.

Head: Face purplish-red in colour; eyes were sunkened and orbital regions slightly purplish-blue. Zygomatic bones prominent. Corneae and conjunctivae slightly dry. Pupils symmetrically dilated and equal. Lips slightly purplish-blue in colour.

Chest: Symmetrical.

Abodmen: Slightly scaphoid in shape, showed no remarkable change.

Extremities: No particular change except already mentioned.

Chest cavity: Neither adhesion nor free fluid was found in either of the chest cavities. No abnormal fluid was found in the pericardial sac. The height of diaphragm was at the 4th rib on the right, at the 4th intercostal space on the left.

Abdominal cavity: Peritoneum showing discrete haemorrhagic spots was diffusely covered with small amount of slimy material. Great omentum with reduced amount of fat covered the top of intestinal loops. Mesentery lymph nodes were enlarged, each to about the size of a pea.

Examination of Internal Organs

Thymus: Partly involuted.

Heart: The size was nearly as large as the fist of the patient. Epicardium was comparatively smooth but with some haemorrhagic spots. Both ventricles contained small amount of fluid blood and clots which were dark red in colour. Myocardium slightly cloudy, endocardium smooth but reddish-brown in colour. Valves showed no remarkable change. Ascending aorta and aorta had no change.

Lungs:

Left: The surface of the upper lobe was smooth and greyish red in colour. The parenchyma was homogeneously soft in consistency, containing moderate amount of air. From the cut surface which was greyish-red in colour, small amount of frothy fluid could be squeezed out. Hilus lymph node was about the size of a pea. The mucous membrane of the bronchi was slightly congested and covered with a small amount of mucus.

Right: On the lower surface of the upper lobe there was a subpleural tubercle of about the size of the small finger tip; its cut surface was caseous and its surrounding tissue slightly fibrotic. The surfaces of the middle and lower lobe were smooth and dark red in colour, homogeneous in consistency containing less air. Each of the two hilus lymph nodes was enlarged to the size of the tip of the small finger; the cut surfaces showed central caseation with a fibrous capsule. Mucous membrane of the bronchi moderately congested.

Liver: Size: Length 25 cm. (right 14.5), width 13 cm. (left 6), height 6 (left 2). Surface was smooth, shining and reddish-brown in colour; on section, it was reddish-brown in colour, and smooth, showing clear lobulations. Moderate amount of blood was squeezable. Bile ducts and portal veins showed no change.

Gall-bladder: It contained a small amount of bile which was dark greenish-brown in colour. Mucous membrane showed no remarkable change.

Spleen: Size: 12 x 6.5 x 2.0 cm. Capsule slightly wrinkled was reddish purple in colour. Its cut surface was red. Lymphoid follicle and trabecules were relatively distinct.

Kidneys: Size: Lt. 10.5 x 5.5 x 2.0 cm.
Rt. 10.5 x 5.5 x 2.0 cm.

Capsules of the both kidneys stripped with ease.
Surface of the kidneys smooth, shining and reddish-brown. Cortices sharply demarcated from the medullae.

Adrenal glands: No remarkable change.

Pancreas: No particular change.

Stomach: It contained a small amount of yellowish-white fluid, and its mucosa was generally covered with mucus.

Small intestines: The contents of the lumen of the duodenum and jejunum were yellowish in colour and the mucous membrane showed no remarkable change. The ileum was generally dilated, with thinned wall containing large amount of watery stool. Mucosa was slightly congested and covered with thick mucus showing superficial desquamation of epithelium. The capillaries in the serosa of ileum were dilated and congested.

Large intestine: A large amount of watery stool was contained in the lumen and its mucosa was covered with slimy material.

Tongue: Dry and dirty.

Tonsils, pharynx, larynx, esophagus, and trachea showed no remarkable change.

Brain: No remarkable change.

Remarks: The following specimens were obtained and sent to the laboratory of CSEPS for histological, chemical and bacteriological examniations: A segment of intestine, stomach with its content, a piece of liver with gall-bladder, bladder with its contents, and a tube of peptone-water inoculated with the contents of the small intestine.

Reported by Chong Hi-Won,
Prosector, CSEPS.
May 19, 1952

Microscopic Examination

Small intestine:

Wall of the intestine is generally thinned. Capillaries of the serosa are dilated and congested. Mucous membrane shows superficial desquamation with marked mucous secretion. Slight edema and congestion are observed in mucosa. The latter are infiltrated with lymphocytes, mononuclear cells, eosinophils and some polymorphonuclear leucocytes. Lymphoid apparatus in the lamina propria of the mucous membrane show slight proliferation. Desquamated epithelial cells and mucus are in the lumen.

Sections stained with either methylene blue or Pfeiffer's stain or the Gram Stain reveal Gram-negative micro-organisms resembling vibrios, frequently seen in the glands Lieberkuhn as well as in the desquamated material.

Conclusion:

The essential pathological findings in this case are acute catarrhal, desquamative enteritis, marked dehydration and petechial haemorrhages of epicardium and peritoneum. The latter was covered with slimy material. Gram-negative vibrio-like micro-organisms are seen in the glands of Lieberkuhn and desquamated material of the small intestine. Also the above mentioned organisms were isolated from the stool of the patient bacteriologically. All these findings are compatible with the fact that this case died of cholera.

Reported by Nam Chang-choon, M.D. (Seoul)
Pathologist, CSEPS.
May 28, 1952.

IV. REPORT OF BACTERIOLOGICAL EXAMINATIONS

(1) On Specimens of Clams.

No. and Name of Specimens:

No. 653-2..... The remains of clams found in the patients' kitchen.

No. 653-3..... A clam found in the patients' kitchen.

No. 653-4..... Two clams found on the hill.

Condition of the Specimens: Each of the specimens was put in a can and wrapped with newspaper separately.
Date of Collection: May 19, 1952.
Location of Collection: Dai-dong, Goon, Pyong-an-nam Do.
Date of Examination: May 19—May 25, 1952.

Examination and Result

Each of the specimens to be examined was inoculated into a large test-tube containing about 40 c.c. of peptone-water with pH 7.8 and incubated for 12 hours at 37°C. Then they were isolated on agar-plate media. Pure culture thus obtained was examined and gave following results:

The growths of the four strains, isolated from the specimens were essentially the same and showed the following features.

(1) Colonies developed after 16 hours of incubation on the agar-plate at pH 7.8 were transparent, hyaline, bluish in colour and of S-type.

(2) Agglutination test on slide:
Positive with cholera anti-serum,
Negative with *Salmonella* poly-valent anti-serum,
Negative with *Shigella* poly-valent anti-serum.

(3) Staining: Staining by Pfeiffer's method showed comma-shaped vibrio. The organism was Gram-negative.

(4) Motility: Characteristic motility was observed after 12 hours of incubation in peptone-water with pH 7.8.

(5) Indol reaction: Positive with Ehrlich's reagent after 48 hours incubation in peptone-water with pH 7.8.

(6) Cholera red test: After 48 hours of incubation in peptone-water containing 0.01% KNO_3 with pH 7.8, cholera red test was positive by adding two drops of sulfuric acid.

(7) Liquefaction of gelatin in characteristic manner was observed after 60 hours of incubation.

(8) Cholera bacteriophage phenomenon:

Strains in broth after 6 hours' incubation at 37°C was inoculated on agar-plate and dried for half an hour in the incubator, and then phage was also inoculated on it, and kept in the incubator for 5 hours. Then this was taken out and left at room temperature for 24 hours and examined. Positive phage phenomenon was observed.

(9) Haemolysis test: To 1 c.c. of growth in broth after 3 days' incubation, 1 c.c. of 5% sheep blood was added and kept in incubator for two hours and then left in the room temperature for 24 hours. The results were negative.

(10) Sugar fermentation: The strains were inoculated into sets of peptone-water with 1% of various saccharides and kept in the incubator for 5 days. Glucose, saccharose, maltose, levulose, mannose, and mannite were fermented; and lactose, arabinose, dulcite and xylose remained unchanged. There was no gas formation.

(11) Quantitative agglutination test:
Positive: H-Agglutination at 1:6,400,
O-Agglutination at 1:1,600.

(12) The strain isolated from the specimen No. 653-2 was then subjected to Pfeiffer's test. The results were positive.

On the basis of the above mentioned results, the strains isolated from the four specimens to be examined were proved to be *Vibrio cholerae*.

Reported by Kim Rak-Ze
Bacteriologist, CSEPS.
May 25, 1952.

(2) On Specimens of Stools

No. of Specimen: No. 653-8, 9.
Name of Specimen: Stools of patients.

Condition of Specimen: Mixed with peptone-water in test-tubes.
Location of Collection: Dai-dong, Goon, Pyong-an-nam Do.
Date of Collection: May 19, 1952.
Date of Examination: May 19–May 25, 1952.

Same results were obtained as in the case of the examinations of specimen No. 653-2. *Vibrio cholerae* was therefore found in the stools of Cho Man-Pok and Li Yeung-za.

Reported by Kim Rak-Ze,
Bacteriologist, CSEPS.
May 25, 1952.

(3) On Specimens of Intestinal Contents

No. of Specimen: No. 653-10.
Name of Specimen: Intestinal content of Cho Man-Pok, taken after death.
Condition of Specimen: Mixed with peptone-water in a test tube.
Location of Collection: Dai-dong, Goon, Pyong-an-nam Do.
Date of Collection: May 19, 1952.
Date of Examination: May 19–May 25, 1952.

Same results were obtained as in the case of the examinations of specimen No. 653-2. *Vibrio cholerae* was found in the intestinal content of Cho Man-Pok.

Reported by Kim Rak-Ze,
Bacteriologist, CSEPS.
May 25, 1952.

V. REPORT OF ZOOLOGICAL IDENTIFICATION

Name of Specimen: Shell-fish   Date of Collection: May 19, 1952.
Specimen No.: 653-3, 653-4.   Date of Reception: May 19, 1952
Collector: Kim Ho-Kyoum
Locality of Collection: Dai-dong Goon, Pyong-an-nam Do.
Identification:

No. 653-3, No. 653-4 Shell-fish; *Meretrix meretrix*
Family: Meretrixidae
Order: Eulamellibranchia

Dr. Won Hong-Ku
Zoologist
May 25, 1952

APPENDIX DD

Hearings on the Dai-Dong Incident (Cholera): Statements of Scientific Experts and Depositions of Eye-Witnesses

Pyongyang, 29th July, 1952

A. **Statements of Scientific Experts**

The Minister of Health (Dr. Ri Ping-nam):

Between 1910 and 1945, i.e. during the whole of the period of occupation of Korea by the Japanese, only 11 epidemics of cholera had been reported in Korea. Of these the most important were:

1916 Aug.-Dec.
1919 Aug.-Dec. (limited areas)
1926 Sept.-Oct.
1932 Aug.-Oct. (very small)
1937 Sept.
1938

In 1946 there was a large epidemic covering all Korea, and this was the only time that it broke out in May, but the morbidity and mortality were less than in some of the former more geographically concentrated outbreaks. In 1947 (Sept.-Oct.) there had been an epidemic in the sourthern part of Korea, but between 1946 and the present time no cases whatsoever had been reported from northern part of Korea. In every one of these previous outbreaks it had been possible to trace the epidemiological origin to a maritime point of entry.

The following conclusions must therefore be drawn:

1) Cholera has never been endemic in Korea,
2) It never started before August, except once in May and once in June,
3) It was always possible to trace them to a maritime point of entry.

The case which he now presented for the study of the Commission was one in which isolated deaths from cholera

occurred in the same rural district in the month of May after the consumption of edible material obviously dropped by an American plane.

The Minister invited the Commission to verify his statements regarding the previous incidence of cholera from the official epidemiological statistics published by the Japanese ("Chosen Boeki Tokei", pub. by Chosen Sodokufu Keimukyoku, 1941), and this was duly done.

Dr. Kim Ho-Kyoum (Chief of the Epidemic Prevention Corps): Several points regarding the clams were worth attention:

1) In Korea clams are not usually wrapped in straw for sale.
2) The season was too early for them by one month.
3) The species of clam found was much more characteristic of the eastern than the western coast, near which they were found.
4) There was no obvious reason why some of the clams should have had broken shells, and these specimens had gone bad.
5) The plane came from the southwest.

(O) No previous instructions had been given to the peasants covering such a case, which had not been anticipated. Only general instructions had been given.

(P) The packets of straw had been photographed. There were from 8 to 10 clams in each one. It now seemed obvious that the intention was to contaminate the reservoirs.

(N) As to the nature and size of these reservoirs, they formed part of the water-supply system for several industrial and harbour settlements at the ports of Nanpo and Kiyang. The water was used both for factories and as drinking-water. A pumping and purification station was situated on the top of a hill, at the bottom of which, on the side further away from Nanpo and Kiyang, there were six ponds fed by springs. Each of these ponds was about 150 ft. x 150 ft. (i.e. about twice the size of a large swimming-bath). A pipe-line led up the hill from them, and down the hill on the other side towards the coastal towns. The distance between the ponds and the pumping station was about 1 km., and the clams were found on the hillside about 400 yards away from the pumping station. On the day be-

fore the clams were dropped, American forces had bombed the hill-top station in such a way as to destroy the purification plant while leaving the pumps intact. Very little damage was done to the pump house, small bombs being used with accurate aim. Before the bombardment the spring-fed ponds were open to the sky, but afterwards they were covered over. The distance between the ponds and the village was about 1 km.

(Z) The house where the cases of cholera occurred was rather isolated from the village.

Dr. Kim Rak-Ze (Bacteriologist):

Made control tests on random samples of flies collected from the village and its neighbourhood especially the patients' house and lavatory, and the houses of neighbours. Samples of 20 flies each were made into a brei, and tested, invariably with negative results for *V. cholerae.*

Dr. Nam Chang-Choon (Pathologist):

Outlined the data presented in the report, and added that he had had previous experience of cholera autopsies in the epidemics of 1940 and 1946.

Dr. Wei Hsi (Professor of Bacteriology at Ta-Lien (Dairen) University, and seconded to the Korean Epidemic Prevention Service.

Participated in the work carried out by the Korean bacteriologists and concurred fully with their findings.

It was to be noted that marine or at least littoral molluscs had been used, and that the cholera vibrio was known to be halophile. The well-known medium of Venkataraman, for instance, contained nearly as much salt as sea-water (ca. 3%).

Moreover, work by Japanese scientists had shown that marine molluscs, especially oysters, were a medium in which the cholera vibrio would grow excellently. Thus Toyama (Nippon Densenbyo Gakukai Zasshi; **Jap. Journ. Infect. Dis.** 1929, 4:101) found that the cholera vibrio would multiply in living oysters with a peak at the third day after inoculation, and numbers maintained well until the seventh day; while on the other hand *B. coli* and the Metchnikov vibrio would not multiply at all under the same conditions. This, and other investigations of a similar

nature, would be found described in the book of Tanigawa Aichi ("Marine Bacteriology" (Suisan Saikingaku) pub. by Seihosha Hakkan, Tokyo, 1943, p. 545).

(M,P,N,) Whether these clams (*Meretrix meretrix*) could live for any length of time in fresh-water he could not say. Probably no work had been done on their physiology, to ascertain how far they were stenohaline or euryhaline. In any case they would eventually die in the fresh-water but during this process, the cholera vibrios would be multiplying in their bodies, and might be constantly discharged into the water. If the valves remained closed, the salinity of the internal medium might be retained for some time, permitting the growth of the bacteria to continue. When the mollusc finally died, the valves would open and all remaining cholera vibrios would be dispersed into the water, which (as other researches had shown) they would be likely to contaminate for 30 days. The marine molluscs might thus almost be regarded as natural closed culture vessels.

Minister: Korean people are fond of eating molluscs, and away from the sea they preserve them in freshwater, where they will live certainly much longer than in air. At first the valves open, but during the dying process they remain closed.

(N) The occurrence of clams heavily contaminated with cholera on a hillside can only be regarded as a highly unnatural phenomenon.

B. Depositions of Eye-Witnesses and Replies to Questions

1) Li Il-Nam (brother of the wife of Cho Man-Pok)
2) Yun Song-Bong (member of the People's Administrative Committee of the Village)
3) Choi Eun-Ryang (farmer)

1) Li Il-Nam confirmed his testimony as given in the Report.

(M) His sister and his brother-in-law certainly ate the clams because conditions of life were very bad as regards food. They had not had anything nice to eat for a long time, and besides they were very hungry at the time.

(O) Yes, in normal times they knew these molluscs, and were accustomed to buy and eat them raw. Everyone enjoyed them, but since the beginning of the war, there had been none for sale.

[The Commission expressed to Mr. Li its deep sympathy for his personal bereavement.]

2) Yun Song-Bong confirmed the testimonies as given in the Report.

(A) The village had about 380 inhabitants.

(M) Besides the spring-fed ponds at the foot of the hill there was also a small reservoir at the top of the hill beside the pumping station. It was about the same size as one of the ponds, and it was not covered over at the time of the bombing, nor had it been since.

The night was quite dark, with no moon, but rather windy. No flares were dropped on the night that the clams were dropped. He listened to the plane droning around for about a whole hour at very low altitude, and he was sure that it was looking for something which it had difficulty in finding. It was so low that he made the people take shelter, though it was after dark (about 10 p.m.). The bombing of the purification plant took place on the 15th., the dropping of clams on the 16th., they were found on the morning of the 17th., and by the evening of the 18th. the two patients were in extremis. The ponds below the hill were covered over only afterwards.

(O) It was not quite the first time that a plane had circled over the village. Six months before the village had been bombed with napalm on a similar occasion.

3) Choi Eun-Ryang confirmed his testimony, had nothing further to add, and concurred in every point with what the previous witnesses had said.

(O) He thought that the straw packing was intended to prevent the shells of the clams being broken when they landed on ground or water.

APPENDIX EE

Memorandum on the Mollusc, *Meretrix meretrix* as an Agent for Carrying *V. cholerae*

(ISCC/11)

From Pyongyang, Korea
WEI HSI, M.D.
Professor of Bacteriology

The ability to live in a solution of higher salt concentration is quite a special property of *V. cholerae.* It can live much longer than other bacteria in a salt solution with concentration (1-5%) higher than that of the physiological saline (0.85%). Venkataraman's preserving fluid for *V. cholerae* is devised on this basis by the addition of sodium chloride, potassium chloride, and magnesium sulphate. The concentration of each of these in the solution is almost a replica of that of the corresponding salts of the sea water. With the adjustment of the hydrogen ion concentration of the solution to pH 9.2 by boric acid-sodium hydroxide buffer, the recorded duration of life of *V. cholerae* in it is around 90 days.

The mollusc, *Meretrix meretrix,* a well known sea food in China, Korea and Japan, is normally found in the sea waters along the coasts of Japan, Korea and China. They are found in the sand about one to two meters below water surface, and are especially abundant in the shallow sea receiving fresh water. There are many species in the genus *Meretrix* (or *Cytherea* as mentioned in some literature), *Meretrix meretrix* being the most common one. In Tanigawa's book on Marine Bacteriology, it is mentioned that a series of experiments conducted by Toyama have shown that the *V. cholerae* do actually multiply tremendously in another kind of sea mollusc. In this mollusc, at a temperature of 15°-25°C, the cholera vibrio gradually multiplies until it reaches a peak on the third day. Here the increment is almost 5000 times in comparison with the original number of organisms introduced. Although the number of organisms gradually drops from that day onward, yet living *V. cholerae* could be still found in the mollusc up to the seventh day.

Judging from the result of this work, it is not surprising at all that *V. cholerae* may also be artifically grown in *Meretrix meretrix.*

The finding of *V. cholerae* in the clams (*Meretrix meretrix*) dropped by an American airplane in Korea is a strong evidence that this principle has been made use of in devising a bacteriological weapon. Presumably, the reasons for using this mollusc as a carrier for *V. cholerae* are: (1) this mollusc is edible and (2) the *V. cholerae* released from the mollusc can pollute the water supply into which the molluscs are thrown, as *V. cholerae* will remain viable in the fresh water for about 30 days.

REFERENCE

(1) 谷川 (Tanigawa, A.) : 水產細菌學, 1943, p. 545.

(2) 中國動物學大辭典, 1924, p. 171.

(3) 藤田經信 (Fujida, T.) : 日本水產動物學 1902, p. 385 。

(4) 日本水產動植物圖集, 1935, Plate 86, Figs. 4-5.

(5) Topley & Wilson: Principles of Bacteriology and Immunity, 1946, London.

APPENDIX FF

Memorandum on Acute Encephalitis — A New Disease in Shenyang (Mukden) and Its Neighbourhood, Produced by the Intrusions of Bacteria Disseminating U.S. Military Planes

(ISCC/6)

Introduction

Since the American Government started bacteriological warfare in Northeast China, an acute infectious disease suddenly broke out in Shenyang (Mukden) and its vicinities. The symptoms and signs of the disease and the analysis of the cerebrospinal fluid accord with the diagnosis of acute encephalitis. Post-mortem examination revealed the lesions of encephalitis. Some patients showed in addition to encephalitis a peculiar type of pneumonia. Judging from the seasonal incidence and clinical and pathological observations, we believe that the disease has never been observed by us in the past.

The present report is based upon observations of patients from Shenyang (Mukden) and its vicinities, in which clinical observations, pathological findings, etiological studies and epidemiological survey will be presented and discussed.

Clinical Observations

The main clinical manifestations of the hospitalized patients were fever, disturbances of consciousness, headache, vomiting and convulsions. The chief symptoms of those died before hospitalization were in general similar to those of the hospitalised patients. The fatality rate of this disease was high. About 73% of the deceased patients died within forty eight hours after the onset. The disease was therefore a fulminating acute infection.

All patients were healthy in the past. They did not have any other acute infection or prophylactic inoculation shortly before the onset of the present illness. No history of recent contact with other patients suffering from acute infections was obtainable for any of them. They fell ill suddenly with no prodromal symptoms. Their main physical signs were those of damage to the central nervous system like disturbances of consciousness,

abnormalities of tendon reflexes, positive Babinski's sign, and those of meningeal irritation such as stiffness of neck and positive Kernig's sign. Only a very small number of patients (about 7%) had the transient upper motor neuron type of paresis. No evidence of spinal cord involvement was detected and there was no paralysis of extra-ocular muscles. Most patients had high body temperature, generally above 39° C. There were no symptoms or signs involving other parts of the body. No skin rash or swelling of the salivary glands was noticed.

The cell count of the patients' cerebrospinal fluid was increased in all cases and the highest count was 220 per cu. mm. Most of the cells, more than 70%, of the cerebrospinal fluid were lymphocytes. The sugar content was in every case above 40mg %. The protein content was elevated in a small number of cases, and normal in the rest. Bacterial cultures of the cerebrospinal fluid were all negative. Blood leucocyte count ranged between 5,000 to 20,000 per cu. mm. and most of the cells were polymorphonuclear neutrophils.

On admission to the hospital, patients' condition was very critical and the serious cases generally died in the first two days of the disease. A small number of patients (about 6%) developed terminal bronchopneumonia as a complication shortly before death.

All recovered cases, during the first two days after admission, remained stuporous most of the time and were unable to take anything by mouth. Following general supportive treatment, the condition gradually improved. About 86% of the recovered cases had a febrile course within six days. The neurological signs and symptoms also gradually disappeared, following the subsidence of fever. About 7% had sequelae in the form of speech disturbances and mental deterioration.

Pathological Examination

The findings of eleven autopsy cases are summarised in the following: All revealed in the central nervous system inflammatory changes of the same nature. Out of the eleven cases, three showed only encephalitic changes without remarkable changes in other parts of the body, while the remaining eight cases had in addition a peculiar type of pneumonia. The inflammatory changes in the central nervous system mainly consisted of all or some of the following features: lymphocytic perivascular infiltration, congestion, hemorrhage, degeneration of nerve cells and formation of glial nodules. Perivascular cellular infiltration was present in every case. It was generally mild but there were cases in which it showed "cuffing". It was found in the white matter of the cerebrum and cerebellum, basal ganglia and brain stem but not found in the substantia nigra and spinal cord. The degree of congestion varied but it was present in every case, being more prominent in small blood vessels. It was

found both in the brain matter and meninges. Fresh small haemorrhages were frequently found, either surrounding small blood vessels or scattered in different parts of the brain and occasionally in the spinal cord. Degenerative changes of nerve cells including chromatolysis, shrinkage, severe change and occasional neuronophagia were mainly seen in the cerebral cortex and basal ganglia but not found in the substantia nigra and spinal cord. A few glial nodules were occasionally seen in the cerebral cortex, pons or medulla oblongata.

The pneumonia as seen in eight cases of this group was characterized by a single, solitary consolidated area, usually very small, the smallest having a diameter of 2 cm. On section it was round or wedge-shaped with the apex pointing to the hilum of the lung. The lesion was more frequently situated in the right upper lobe, in the centre of a lobe not always reaching the pleural surface. The lesion was completely consolidated. Its cut surface was greyish red in color, finely granular, and reminiscent of the state of grey hepatization. It was well-defined and showed a peripheral zone of congestion. The alveoli of the consolidated area were filled up with exudates consisting mainly of polymorphonuclear leucocytes and a varying number of mononuclears. The cellular elements were well stained. The number of cells in the alveoli was variable. In some of the alveoli fine threads of fibrin were found among the cells. Generally speaking the amount of fibrin was small. The alveoli at the periphery of the lesion contained serous fluid or scattered red blood cells in addition to other cellular elements. Most alveolar septa were markedly congested. Some of them were infiltrated by leucocytes and mononuclears. The interlobular interstitial tissue was especially widened because of marked edema and fibrinous exudate. It was congested and infiltrated by cellular elements with foci of haemorrhage. Lymphatics were dilated and filled up with leucocytes. The walls of small bronchioles showed congestion and cellular infiltration.

Etiological Studies

Etiological studies on this group of cases were carried out along the following lines:

(a) Bacterial cultures.

In the eleven post-mortem cases mentioned above, cultures of heart blood and brain were negative. Culture of the consolidated lung tissue was performed for the nine cases of encephalitis associated with peculiar pneumonia and pneumococcus was isolated in three cases. One of the three cases also gave a positive culture of pneumococcus from the spleen.

(b) Isolation of virus.

Cerebrospinal fluid obtained from 20 percent of hospitalized cases in the acute stage was inoculated intracerebrally into guinea pigs and

white mice. No virus was isolated. In seven of the eleven above mentioned postmortem cases, a suspension was prepared from the brain tissue and was inoculated intracerebrally into mice. The suspensions made from the lung tissue of four cases were also inoculated intranasally into mice and into the amniotic cavity and the yolk sac of chick embryos. The lung tissue suspension of another case was inoculated into mice intraperitoneally and into the yolk sac of chick embryos. In none of these instances, could any virus be isolated.

(c) Serological reactions.

Convalescent sera from 28 percent of hospitalized patients, taken in the 4th to 10th week after the onset of their illness were examined for complement fixation reaction against the antigens of Japanese B encephalitis, St. Louis encephalitis, western equine encephalomyelitis and spring-summer encephalitis. The results were all negative.

Epidemiological Survey

Epidemiological survey was carried out on those cases seen at Shenyang (Mukden). The findings may be given as follows:

(a) Regional distribution.

The cases occurred sporadically in different districts of the city.

(b) Time distribution.

The first patient fell ill on March 10, 1952. Since then more cases were discovered in rapid succession. The peak of the epidemic was reached in early April. The incidence then gradually declined (Text Fig. 1).

(c) Age incidence.

The age of patients ranged from 7 months to 58 years.

(d) Sex incidence.

Males were slightly more affected than females. About 59% of all the patients were males.

(e) Case fatality rate was high.

(f) Food and water.

Some patients used water from the city water supply, while others used well water. Most of the patients had their meals at home. Neither the patients nor their family members had any gastro-intestinal disorders before the onset and during the course of their disease. Nothing could be said about the food and water supply of the patients in relation to the development of the present illness.

(g) Housing and environment.

The sanitary condition of patients' houses including bedrooms, kitchens and toilet rooms and their immediate environment were care-

fully surveyed but nothing remarkable could be stated in relation to the development of the present disease.

(h) Insects.

American planes had repeatedly invaded Shenyang (Mukden) and its vicinities and disseminated insects. Whether the present disease was transmitted by insects or not is still under investigation.

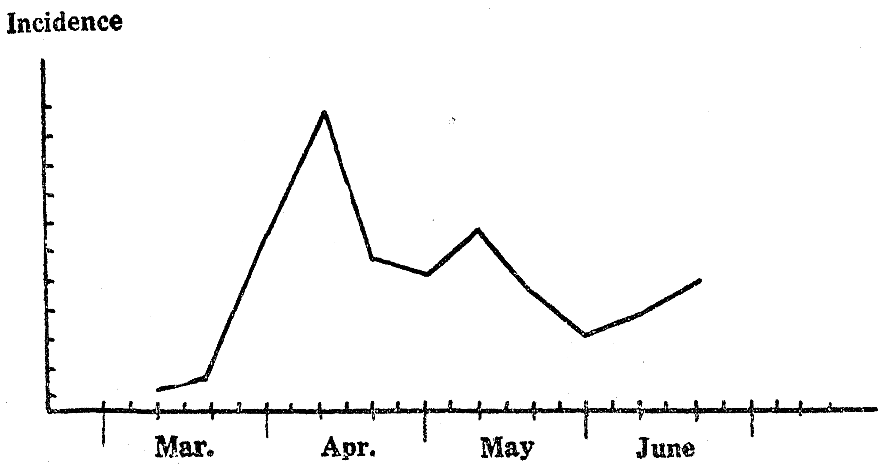
(i) Relation to respiratory infections.

(a) Only about 8% of patients had respiratory symptoms before the onset of the present illness. (b) Before or during patients' illness, 10% of their close contacts had respiratory symptoms. (c) Among the patients themselves, no contact history could be traced.

Discussion

Since the reported cases, recovered or deceased, have the following characteristic points in common, they belong therefore to the same disease entity:

(a) The disease began to appear sporadically in the early part of March, 1952 in Shenyang (Mukden) and its vicinities. This means that the occurrence of the disease was confined to a certain period of time and a certain locality.



Text Fig. 1. Curve showing distribution of cases in different months.

(b) Sudden onset, short clinical course, high fatality rate and death taking place mostly within 2 days, all speak for a fulminating acute infectious disease.

(c) The main symptoms, physical signs and changes in the cerebrospinal fluid indicate that this infectious disease affects the central nervous system.

(d) Post-mortem examination revealed encephalitic changes in all cases and in addition, a peculiar type of pneumonia was found in a portion of the cases. This indicates the complicated nature of the disease.

Judging from the above-mentioned facts, we believe that this disease has never been observed by us in the past.

The clinical features and pathological changes in the central nervous system of this disease are different from those naturally occurring diseases such as encephalitis lethargica, Japanese B encephalitis, St. Louis encephalitis, equine encephalomyelitis, spring-summer encephalitis, acute poliomyelitic encephalitis and acute lymphocytic chorio-meningitis. The differences are stated below:

(a) This type of encephalitis is different from encephalitis lethargica by its shorter clinical course, absence of extra-pyramidal tract involvement or paralysis of ocular muscles, and also by the absence of prominent or important changes in the substantia nigra.

(b) It is also different from the known arthropod-borne virus encephalitides (e.g. Japanese B encephalitis, St. Louis encephalitis, spring-summer encephalitis and equine encephalomyelitis), because no virus has been isolated from the brains of the fatal cases by mouse inoculation. The sera of convalescent patients gave negative results in the complement fixation tests against those four types of encephalitis antigen. Furthermore, it is unlike Japanese B encephalitis because in Northeast China, Japanese B encephalitis occurs from August to November, and after November no new case appears. The pathological changes in the brain of the present group of cases were not so prominent and extensive as those of Japanese B encephalitis. Foci of acute necrosis, characteristic of the latter disease, were also not found. It is unlike equine encephalomyelitis or spring-summer encephalitis because this group of patients gave no clinical evidence of involvement of spinal cord nor pathological changes characteristic of these diseases.

(c) It is different from acute anterior poliomyelitic encephalitis which is usually seen in summer and autumn, mostly with signs of bulbar paralysis. Furthermore, the lesions in the latter are not only limited to the brain but also seen in the grey matter of the spinal cord which is different from the condition of this group of patients.

(d) It does not fit in with the diagnosis of acute lymphocytic choriomeningitis, since our cases had disturbances of consciousness, with serious clinical course and a high fatality rate. Furthermore, the patients' spinal fluid in the acute stage of their illness inoculated intracerebrally into guinea pigs gave negative results for that virus. The cellular infiltrations in the meninges and choroid plexus were also rather mild.

With regard to the pathological changes in the lung, although the position, size and tissue changes of the lesion resemble the localized type of lobar pneumonia, the following points are against it:

(a) All the lesions were small but the disease was rapidly fatal. This is very unusual for lobar pneumonia in infancy and childhood.

(b) This peculiar type of pneumonia occurred also in adults, with a similar rapidly fatal course. This is very unusual with lobar pneumonia in adults.

(c) Clinically, ordinary lobar pneumonia is seldom accompanied by cerebral symptoms. Cerebral symptoms, however, were the main feature of this group of cases. They had no symptoms of pneumonia. Postmortem examination revealed encephalitic changes in all cases.

The above-mentioned characteristics are present in all the cases examined. This type of pneumonia has never been observed by us in the past.

In the early part of our studies, we inoculated the brain and spleen tissues from 2 fatal Anshan cases (404 and 405) intracerebrally and intraperitoneally into white mice. The mice developed convulsions and died in 3-5 days. At that time we entertained the preliminary opinion that the brain and spleen tissue contained a virus. The brain of white mice was then used for further passages. Later, no more death of mice was observed and virus isolation was therefore not achieved.

As recorded before, a strain of neurotropic virus was isolated from crane flies (*Trichocera*) obtained at Anshan. Studies on this virus are still in progress. Judging from our observations so far, its properties are not identical with any of the known encephalitis viruses. Neutralization tests of this virus with convalescent sera from the present series of cases and the immune sera against 4 types of encephalitis viruses (Japanese B encephalitis, St. Louis encephalitis, western equine encephalomyelitis and spring-summer encephalitis) were all negative. So it may be concluded that the virus is not etiologically related with the encephalitis under study. Nor is it identical with any of the 4 types of encephalitis viruses mentioned above.

The etiological agent of the present disease is still not clearly understood. The following possibilities, however, may be discussed:

(a) The isolation and identification of a virus often require years of experimentation and investigation. Up to now no virus has been isolated from patients suffering from this type of encephalitis. However, only a limited variety of animals and experimental methods have been used, it is therefore desirous to continue the work on the isolation of the virus.

(b) The fact that pneumococcus was isolated from the consolidated lung tissue in some cases leads us to consider whether or not the pneumo-

coccus is the causal agent of the pneumonia and producing secondary toxic encephalitis. But the evidence at hand is not sufficient to establish pneumococcus as the principal etiological agent of the disease.

(c) The complexities of the clinical, pathological and etiological findings suggest the possibility that the disease may be caused by a synergistic action or mixed infection of a certain bacterium and a virus. Synergism of bacteria and viruses has long been proved, particularly in the instance of swine influenza. In the latter disease, only the swine influenza virus in combination with *Haemophilus influenzae suis* can cause the disease in the swine. During the pandemic of influenza in 1918-1919, the pneumonia from which many of the patients died was caused probably also by mixed infection of influenza virus with certain bacteria. Thus the combined or synergistic action of bacteria and virus not only enhances the invasiveness of the virus but also alters the clinical and pathological picture of the disease. Rosebury and Kabat (J. Immunol. 56:7, 1947) in discussing bacteriological weapons, mentioned repeatedly the possibility of mixed infection which they considered should receive further intensive research. This possibility, therefore, deserves serious consideration in connection with the etiology of the present disease.

In the same article, they mentioned also the possible use of variants of pathogens, artificially induced, as well as the use of unusual portals of infection. Employment of these unnatural means would induce an unusual type of disease, creating many diagnostic difficulties.

On the whole, judging from the complicated clinical and pathological findings, we believe that the etiology of the disease we are dealing with must be very unusual and complex.

Conclusions

From the facts mentioned above, we consider that the disease under study is unusually complicated and has never been observed by us before. Though the etiological agent is not yet definitely known, it is certainly highly virulent in view of the fulminating nature of the disease. Since the disease occurred suddenly in places after the intrusions of American bacteria-disseminating planes, we conclude, therefore, that the encephalitis and peculiar type of pneumonia were produced by the bacteriological warfare carried on by the American government. Owing to the fact that the etiology and epidemiology are still now under investigation and no definite conclusion is yet reached, this report is prepared in the form of a memorandum. A new supplementary report will be published as soon as our investigations are finished.

DOCUMENT FF-1

ABSTRACT OF CLINICAL REPORT

CASE A. F.Y.S., male, a merchant of Shenyang (Mukden), twenty years old. Past health was always good except for a brief attack of acute dysentery in summer 1951. He did not have any other acute infectious disease in the last two years and received no prophylactic inoculation shortly before the onset of the present disease.

At 5:00 p.m. March 26, 1952, he was suddenly ill with chills, high fever and perspiration. Vomiting occurred twice. In the night, he experienced dizziness and headache. On the second day of the disease, he became mentally confused and drowsy. Hence he was admitted to the Municipal Isolation Hospital of Shenyang (Mukden).

On admission, the body temperature was 40.6° C. and pulse rate 130. He was stuporous. No skin eruptions or petechiae were found. Pupils were round and slightly dilated, reacted to light sluggishly. No abnormal finding was detected in the nose, ears and throat. Neck was stiff. Examination of heart, lungs, abdomen and extremities revealed normal findings. Abdominal, cremasteric and all tendon reflexes were diminished. Kernig's sign was positive. Babinski's sign and other pathological reflexes were negative. Laboratory examination: Blood—WBC 19,800 per cu. mm.; 79% PMN. Cerebrospinal fluid—clear; cell count 32 per cu. mm., all lymphocytes; sugar 52 mg.%; protein normal and bacterial culture negative.

After admission, he was given general supportive treatment. Although fever gradually subsided since admission, he was still stuporous and unable to take anything by mouth during the third and fourth days of disease. His lungs were clear. On the fifth day of disease, he became mentally clear gradually and all tendon and superficial reflexes were normal, but some headache still persisted. Signs of meningeal irritation subsided completely on the sixth day. His general condition showed progressive improvement and he was discharged on the eleventh day of disease in good condition. A second examination of cerebrospinal fluid made shortly before discharge revealed normal findings. There were no sequelae on follow-up examination.

Diagnosis: Acute encephalitis.

Kuo Ai-jan, M.B., Assistant Professor of Medicine, National Medical College, Shenyang.

Chang Hsüeh-tê, M.S., M.D., Physician, China Union Medical College, Peking.

Wu Chih-chung, M.B., Professor of Medicine, National Medical College, Shenyang.

CASE B. C.H.K. is a boy of seven years old, living in the suburb of Shenyang (Mukden). His past health was robust and he did not suffer from any important acute infectious disease in the past. He was vaccinated once in spring, 1951, but received no prophylactic inoculation shortly before the onset of the present disease.

In the night of April 7, 1952, he suddenly experienced headache and fever. He had also several attacks of nausea and vomiting. On the second day of disease, headache became severe and he was drowsy. Mental stupor set in on the third day of illness with frequent attacks of delirium and he was then admitted to the Municipal Isolation Hospital of Shenyang.

On admission, he was found to have fever of 39.4°C. and pulse rate of 139 per minute. He was mentally stuporous. No skin rash or petechiae was noticed. Pupils were round and slightly dilated on both sides with sluggish light reflex. Corneal reflex was present. His nose, throat and ears were normal. His neck was stiff. Physical examination of heart, lungs and abdomen revealed no important finding. There was no paralysis of the extremities. Tendon reflexes of the upper extremities were normal. Knee and ankle jerks were sluggish. Abdominal reflexes were present. Kernig's sign was positive; but Babinski's sign and other pathological reflexes were negative. Laboratory examination: Blood count—WBC 7,400 per cu. mm.; PMN 78%. Cerebrospinal fluid—clear; cell count 187 per cu. mm. with 77% lymphocytes and 23% PMN; sugar 52 mg.%; protein normal; bacterial culture negative.

After admission, he was given general supportive treatment. On the fourth day of the disease, the fever still fluctuated around 39°C., but his mental condition began to show some improvement. Kernig's sign was positive and neck was still stiff. Other neurological findings remained as before. On the seventh day of illness, fever subsided, all tendon reflexes became normal, and signs of meningeal irritation disappeared. Cerebrospinal fluid examination repeated two days later on the ninth day of illness revealed no abnormal findings. General condition gradually improved and he was discharged on the fourteenth day of disease in good condition with no sequelae.

Diagnosis: Acute encephalitis.

Kuo Ai-jan, M.B., Assistant Professor of Medicine, National Medical College, Shenyang.

Chang Hsüeh-tê, M.S., M.D., Physician, China Union Medical College, Peking.

Wu Chih-chung, M.B., Professor of Medicine, National Medical College, Shenyang.

CASE C. H.C.T., male, factory worker, 23 years old and a resident of Shenyang (Mukden), was in good health in the past. He did not have any important acute infectious disease in the last two years. No past history of venereal diseases or pulmonary tuberculosis. Received no prophylactic inoculation shortly before the onset of the present disease.

He was suddenly sick on April 8, 1952, with general malaise and headache. On the next day fever developed and on the third day of disease symptoms remained more or less the same. On the fourth day of disease the patient became stuporous and mentally confused with delirium. He was, therefore, admitted to the Municipal Isolation Hospital of Shenyang.

On admission, he was found to have fever of 40.3°C. and pulse rate of 105 per minute. He was mentally confused and stuporous. No skin rash or petechiae was found. Pupils were round and equal with sluggish light reflex. Corneal reflex was also sluggish. No icterus. Ears, nose, and throat were normal. Neck was stiff. Examination of heart and lungs revealed normal findings. No motor disturbances. All tendon and abdominal reflexes were normal. Kernig's sign and Babinski's sign were both positive. Other pathological reflexes were negative. Laboratory examination: Blood—WBC 6,400 per cu. mm. and PMN 85%. Cerebrospinal fluid—clear; cell count 181 per cu. mm. with 12% PMN and 88% lymphocytes; sugar 66 mg.%; protein normal; bacterial culture negative.

After admission, he was given general supportive treatment. On the fifth day of the disease, though his body temperature dropped to 38.8°C., he was still mentally cloudy complaining frequently of headache with stiffness of neck and positive Kernig's sign. Fever gradually subsided on the seventh day of the disease and he became mentally clear with the subsidence of signs of meningeal irritation. His appetite increased. Cerebrospinal fluid was re-examined on the eighth day of the disease with normal findings. His general condition showed progressive improvement and he was discharged in good condition on the twelfth day of disease with no sequelae.

Diagnosis: Acute encephalitis.

Kuo Ai-jan, M.B., Assistant Professor of Medicine, National Medical College, Shenyang.

Chang Hsüeh-tê, M.S., M.D., Physician, China Union Medical College, Peking.

Wu Chih-chung, M.B., Professor of Medicine, National Medical College, Shenyang.

DOCUMENT FF-2

AUTOPSY REPORTS

REPORT NO. I

Name: W.S.L. Age: 6 Sex: male
Date of death: March 26, 1952, at 5:00 p.m.
Date of autopsy: March 27, 1952, at 11:00 p.m.

Clinical History

The patient was a boy six years old and had been always healthy until March 23, 1952, when he was suddenly taken ill with high fever, restlessness, insomnia and perspiration. The next day he was delirious. Convulsions were observed on the third day, and were soon followed by coma. He was then sent on the same day to the Municipal Isolation Hospital of Shenyang for treatment.

At the time of admission, the patient's temperature was found to be 39°C, pulse weak, and respirations rapid. He was unconscious, and convulsions were observed frequently. The light reflex of the pupils and corneal reflex were sluggish. The knee jerks, ankle jerks and abdominal reflexes were lost. The neck was stiff and Kernig's sign was positive. Babinski's sign was negative. Sphincter control was lost. The blood picture: white blood cell count was 12,000 per cu. mm., 77% of which were neutrophils. The cerebrospinal fluid: the pressure was 90 mm. water column; colorless and clear; cell count was 99 per cu. mm., of which 77% were lymphocytes; sugar content, 59 mg.%; a trace of protein; bacterial culture negative. The patient remained in coma all the time. His fingers were cyanotic. Moist râles could be heard at the base of both lungs posteriorly. He died 5 hours after admission to the hospital.

Gross Examination

The body is that of a well developed and moderately nourished male child measuring 104 cm. in length and 17.5 kg. in weight. There is diffuse lividity over the back; rigor mortis is present. Skin normal, no rashes or marks of injury. Cornea clear. No enlarged lymph nodes felt.

Peritoneal Cavity: The surface of peritoneal membrane is smooth and glistening.

Pleural Cavities: Pleural surfaces are smooth and glistening. There is no accumulation of fluid.

Pericardial Cavity: Contains a small amount of clear fluid.

Heart: Weight 56 gm. There are 5 pin-head sized hemorrhagic spots in the epicardium, and there is also a small hemorrhagic spot on the

papillary muscle of the left ventricle. The endocardium is smooth, and there is no inflammatory change of the valves. Circumferences of orifices: tricuspid—6.4 cm. pulmonary—3.5 cm. mitral—5.4 cm. aortic—3.4 cm. Thickness of the left ventricle is 0.8 cm. and that of the right ventricle is 0.3 cm.

Lungs: The surfaces of the visceral pleura of both lungs are smooth and glistening, without hemorrhagic spots. There are only two lobes of the right lung due to congenital anomaly. The upper lobe is soft and only the lower and posterior parts show slight congestion. The lower lobe of the right lung is congested, and besides, there are diffusely scattered greyish-white small consolidated foci which are irregular in shape and size. Most of the consolidated foci measure about 3-5 mm. in diameter. The condition of the left lung is similar to the right. There is no consolidation in the front and upper parts, whereas consolidation is present in the posterior and lower parts. The lymph nodes of the hilum on the right side are enlarged and soft (1.2 x 1.8 cm.), the cut surface of which shows congestion but no hemorrhage. Those on the left side measure 0.6 x 1.1 cm., with slight congestion.

Liver: Weight 450 gm. The capsule is smooth, under which congestion can be observed. The cut surface also shows marked congestion, while it remains brownish-yellow in color only at a few places.

Gall Bladder: Contains about 10 ml. of bile. The wall is not thickened, nor is there any inflammatory reaction of the mucosa.

Pancreas: Weight 22 gm. The cut surface shows congestion, and lobulation is distinct.

Spleen: Weight 40 gm., moderately firm. Lymph follicles are small, but distinct.

Gastro-intestinal Tract: The serosa of the stomach is smooth and glistening; the mucosa shows no ulcer. There is also no ulcer in the duodenum. The jejunum contains bile-stained mucus and small amount of feces and the serosa shows moderate congestion. The ileum is dilated at several places. Peyer's patches are prominent. Cecum is moderately dilated, with walls thinned out. Appendix 5 cm. long, 0.4 cm. across and its serosal surface smooth. The mucosa of the entire gastro-intestinal tract shows no hemorrhage or evidence of inflammation.

Kidneys: The right kidney weighs 37 gm., the left kidney 44 gm. Capsule strips off easily, leaving marks of fetal lobulation. Cortex is 0.4 cm. thick.

Adrenals: The right adrenal gland weighs 1.9 gm. (The left one not weighed).

Tonsils: There are two cysts in the right tonsil, one of which is 0.8 cm. in diameter, the other is 0.3 cm. The inner surface of the cysts is smooth and glistening.

Thyroid: Weight 4.6 gm. Shape normal. Cut surface is brownish red and shows no cyst or tumor.

Thymus: Weight 11 gm. Cut surface is greyish white, but the vessels are congested.

Central Nervous System: The brain weighs 1040 gm. Its shape, size and consistency are normal. The leptomeninges are thin and shiny, and there is congestion but no hemorrhage, exudate or other change. The coronal sections of cerebrum reveal congestion of the white matter. The cerebral cortex, basal ganglia, brain stem, cerebellum, ventricles, ependyma, choroid plexus and spinal cord all showed no remarkable change.

Microscopic Examination

Heart: There is slight lymphocytic infiltration around the blood vessels and in the stroma of myocardium.

Lungs: In the sections of the posterior portions of the lungs there are many foci of inflammation, showing lobular distribution. The alveoli contain polymorphonuclear leucocytes, a small amount of fibrin, red blood cells and phagocytes with coal dust particles. There are also alveoli containing red stained serous fluid. The bronchioles in these inflammatory areas contain similar exudate. The walls of these bronchioles show infiltration by lymphocytes and a small number of polymorphonuclear leucocytes. In areas with no pneumonic change, the alveolar walls are congested. In the sections of the anterior upper portion of the lungs, the alveolar walls are slightly thickened with infiltration by polymorphonuclear leucocytes and lymphocytes. The bronchioles contain polymorphonuclear leucocytes, but the surrounding alveoli do not contain similar cells. In the bronchial lymph nodes the reticulo-endothelial cells are hyperplastic. Gram-stained section of the lung shows no bacteria.

Liver: Shows moderate congestion. The liver cells are slightly swollen. The cytoplasm appears red and granular. A few lymphocytes can be seen in the portal areas. In the sections stained by Sudan III, the liver cells in the region of the portal areas show slight fatty change.

Gall Bladder: There is no inflammatory change in the walls. The epithelium shows marked postmortem changes.

Pancreas: No significant change found.

Spleen: Moderate congestion occurs in the red pulp. There is a few polymorphonuclear leucocytes in the pulp cords. The germinal

centers of the follicles show moderate reticulo-endothelial hyperplasia. Capsule, trabeculae and blood vessels are normal, showing no inflammatory changes.

Gastro-intestinal Tract: Except for mild congestion, nothing is remarkable.

Kidneys: The glomeruli are normal. The capsular spaces of a few glomeruli contain coagulated albuminous material. The epithelial cells of the convoluted tubules are swollen; the cytoplasm appears red and granular, containing large red homogenous bodies (colloid change). Such bodies are easily found in the epithelium of the convoluted tubules near the glomeruli. In the sections stained with Sudan III, the epithelium of some tubules shows mild fatty change. Hyaline casts are sometimes found in the lumens of the tubules. Pelves show no special change.

Adrenals: The cells in the cortex contain very little lipoid material. Some vessels show slight congestion.

Thyroid: The follicles vary in size, with no cystic change. The lumen of the follicles contains colloid material which stains light red. Many epithelial cells form solid clusters without lumen formation.

Tonsils: The follicles are enlarged. There is lymphocytic hyperplasia. Some of the crypts show cystic enlargement with desquamated cornified epithelial cells in them. Beside the desquamated cells, leucocytes are also found in some of the crypts.

Thymus: Both the cortex and medulla are still cellular; stroma not increased.

Central Nervous System:

Cerebrum: Sections are taken from the frontal, central, temporal and occipital regions. The leptomeninges contain a few lymphocytes and red blood cells. The meningeal vessels are congested. The intracerebral vessels are also congested, more marked in the central section, with small foci of hemorrhage. Perivascular infiltration of lymphocytes is mild in general, but it is marked in the white matter of occipital lobe, where it appears in the form of heavy "cuffing". In addition, there is also mild perivascular glial infiltration. The nerve cells in different sections show wide-spread degenerative changes of various kinds, such as chromatolysis, shrinkage, severe cell change and neuronophagia.

Cerebellum: The leptomeninges show similar changes as those of the cerebrum. The intracerebellar vessels are congested, without perivascular infiltration or hemorrhage. The Purkinje cells show chromatolysis and the cells of the dentate nucleus show severe change.

Basal Ganglia: The congestion in this section is similar to that occurring in the cerebrum, with also fresh small hemorrhages. The perivascular lymphocytic infiltration is mild. The nerve cells show shrinkage and extensive severe change.

Mid-brain, Pons and Medulla: Shrinkage of the nerve cells is seen in the mid-brain, but the cells of the substantia nigra do not show remarkable change. Severe cell change and neuronophagia are seen in the pons. Eccentricity of the nucleus and central chromatolysis are seen in the nerve cells of the dorsal motor nucleus of the vagus.

Spinal Cord: Small hemorrhage is present in the thoracic cord.

Choroid Plexus: No remarkable change.

Note: Bacterial cultures of heart blood, brain, lung, and spleen are negative.

Pathological Diagnoses

Acute encephalitis.

Bilateral terminal lobular pneumonia and bronchiolitis.

Punctate hemorrhages in pleura, pericardium and papillary muscle of the left ventricle.

Congestion of lungs, liver and spleen.

Cloudy swelling and fatty change of liver and kidneys.

Reported by:

Hu Cheng-hsiang, M.D., Professor of Pathology, China Union Medical College, Peking.

Li Pei-lin, M.B., Ph. D., Professor of Pathology, National Medical College, Shenyang.

Hsü Ying-k'uei, M.D., Associate Professor of Neurology and Psychiatry, China Union Medical College, Peking.

Wu Tsai-tung, M.B., Professor of Pathology, Medical College. Nanking University.

Lin Chen-kong, M.B., Professor of Pathology, Medical College, Peking University.

REPORT NO. II

Name: C. K. C. Age: 5 Sex: Female
Date of death: April 23, 1952, 1:00 a.m.
Date of autopsy: April 23, 1952, 2:00 p.m.

Clinical History (abstract)

Patient had been always well until the night of April 21, 1952 when she suddenly had fever, headache, repeated vomiting, convulsions and unconsciousness. She died at home on April 23, 1952.

Gross Examination

The body is that of a young girl, measuring 103 cm. in length and 16 kg. in weight. Rigor mortis still present in extremities. Widespread lividity on back. No rash or hemorrhage. Cornea with mild clouding on both sides and pupils of equal size. External auditory meatus and nostrils with no discharge. A small wart is found under the outer canthus of the left eye, measuring about 0.5 cm. in diameter. No palpable enlarged lymph glands in the cervical, axillary and inguinal regions. Chest symmetrical. Abdomen level. External genitalia and anus show nothing abnormal.

Pleural Cavities: No abnormal accumulation of fluid. Pleural surface smooth and glistening. The posterior and lower surface of the left lower lung shows fibrous adhesions with chest wall and diaphragm.

Peritoneal Cavity: There is no accumulation of fluid. Peritoneal surface smooth and glistening. Abdominal organs and intestines are in their normal positions.

Heart: Weight 80 gm. Pericardium, endocardium and valves are all smooth and glistening. Myocardium brownish red in color. Openings of the coronary arteries show nothing abnormal.

Circumferences of orifices: tricuspid 7.8 cm., pulmonary 5.5 cm., mitral 7.0 cm., aortic 4.0 cm. Thickness of left ventricle 0.8 cm. and that of the right ventricle, 0.2 cm.

Aorta: Intima smooth and glistening, stained pinkish by hemolyzed blood after death.

Lungs: Right lung shows no adhesions. The visceral pleural surface smooth with no hemorrhage. The lung tissue is soft and air-containing. The cut surface is dark red in color and rich in foamy bloody fluid, but without consolidation. The left lung has complete fibrous adhesions between the upper and lower lobes. In the lower portion of the upper

lobe there is a small area of consolidation near the interlobar fissure in the neighborhood of the hilum, measuring about 2.5 x 1.8 x 1.5 cm. It is nearly wedge shaped with its base on the interlobar surface and apex toward the hilum. The cut surface of this area is firm, finely granular, grayish red in color and sharply demarcated from the surrounding air-containing normal lung tissue. The adjacent hilar lymph node is soft and slightly enlarged, measuring 1.0 x 0.7 cm. Its cut surface is dark red in color with black pigment. Bronchial mucosa congested. The lung tissue surrounding the consolidated area is also congested, while the rest of the pulmonary tissue is air-containing, soft or edematous.

Liver: Weight 480 gm. The capsule appears tense and the surface smooth, glistening and brownish red in color. Cut surface slightly bulging. Lobulations indistinct.

Spleen: Weight 70.5 gm. Capsule also tense but smooth. Cut surface soft and swollen with edges everted. Lymph follicles indistinct.

Gastro-intestinal Tract: The gastric mucosa is congested, especially on the top of the folds. Mucosa of duodenum, jejunum, ileum and colon is normal, but the Peyer's patches and solitary lymph follicles are prominent. Several ascaris are found inside the gut. The mesenteric lymph nodes are enlarged, the largest measuring 1.5 x 0.5 cm., soft in consistency. Cut surface distinctly congested.

Pancreas: Weight 35 gm. Cut surface slightly congested.

Kidneys: Left kidney weighs 64 gm. and right 54 gm. Capsule strips off easily, leaving marks of fetal lobulations. Surface congested. On section both cortex and medulla are markedly congested. Thickness of cortex 0.3 cm. Mucosa of renal pelvis slightly congested.

Adrenal Glands: Left adrenal weighs 4.5 gm., right 3.0 gm. On section, cortex is found to be very thin and greyish white in color, containing a few yellow specks. Medulla dark red in color.

Urinary Bladder: Distended with urine. Mucosa greyish white in color without signs of congestion.

Uterus: Myometrium and mucosa slightly congested.

Ovaries: Each ovary measures 2.5 cm. in length and 0.3 cm. in thickness. They are greyish white in color and firm in consistency. Cut surface contains several follicles with clear fluid inside.

Neck Organs: The lymph follicles at root of the tongue are prominent. Pharyngeal and laryngeal mucosa normal without signs of congestion or inflammation. Tonsils not enlarged. The lower part of tracheal mucosa is congested and dark red in color. The submaxillary lymph

nodes are enlarged, the largest measuring 2.5 x 1.5 x 1.0 cm.; soft in consistency. Cut surface greyish white with a tint of red.

Central Nervous System: The brain weighs 1020 gm. Normal in size, shape and consistency. The leptomeninges show no remarkable change. Coronal sections of the cerebrum show congestion in the white matter of the occipital lobes. The cerebral cortex, basal ganglia, brain stem, cerebellum, ventricles, ependyma and spinal cord show no remarkable change. The choroid plexus in the posterior horn of the right lateral ventricle is congested.

Microscopic Examination

Heart: The pericardium contains a good deal of adipose tissue. The myocardial fibers show clear cross striations. In the interstitial tissue, there is infiltration of a few lymphocytes and large mononuclear cells.

Lungs: The solidified area in the left upper lobe shows marked congestion of the alveolar septa. The alveoli are filled with polymorphonuclear neutrophiles and mononuclear cells. Some of the latter contain coal pigment. Among the leucocytes there are also eosinophiles. A small amount of fibrin and red blood cells are also found in some parts of the alveolar exudate. The bronchioles show congestion and infiltration of the same cellular elements in their wall with desquamation of epithelium in their lumen in which large numbers of leucocytes are collected. The pleura over this part of the lung has also the same kind of acute inflammatory exudate. The alveolar walls around this solidified area are also congested and are thickened by the infiltration of polymorphonuclear leucocytes and mononuclear cells. The alveoli of the more distant parts are filled with edematous fluid. Some become distended with air and others collapsed. In the Gram-stained sections, no bacteria are found.

Section of the right lung shows congestion and edema. The alveolar walls show slight infiltration of lymphocytes and mononuclear cells.

Bronchial Lymph Nodes: Show marked congestion and reticulo-endothelial hyperplasia.

Liver: The liver cells are swollen in most parts, showing pink-colored granules in the cytoplasm, which is also marked by the presence of small round vacuoles. The portal spaces are infiltrated with moderate number of lymphocytes and also some polymorphonuclear leucocytes and eosinophiles. The central zone of the lobules shows moderate congestion.

Spleen: The follicles are small in size and not distinctly marked off from their surrounding tissue. But there are occasional germinal centers. The sinusoids are congested and the reticulo-endothelial cells are

hypertrophic. The red pulp shows increase of cells, leucocytes and some eosinophiles. The capsule shows no remarkable change.

Pancreas: Nothing remarkable.

Stomach: Not remarkable.

Duodenum, Ileum and Colon: There is no important change except for moderate congestion.

Kidneys: The vessels in the cortex and medulla and the glomerular capillaries are all engorged. The epithelial cells of the convoluted tubules are swollen, showing pink-stained granular change of the cytoplasm with irregular edges. The lumina are dilated and sometimes are filled with threads of pink-stained albuminous material.

Bladder: Not remarkable.

Adrenal: Moderate congestion. Cortical cells are small showing deprivation of lipoid.

Lymph Nodes: Cervical lymph nodes congested. Lymphoid and reticulo-endothelial cells hyperplastic with prominent lymph follicles. The mesenteric lymph nodes show only moderate reticulo-endothelial hyperplasia.

Tonsils: A few of the crypts are filled with desquamated cornified epithelial cells and a small amount of white cells. In the lymphoid tissue, besides mild congestion of the vessels, there is no remarkable change.

Central Nervous System:

Cerebrum: Sections are taken from the frontal, central, temporal and occipital regions. The leptomeninges show slight infiltration of lymphocytes, mononuclear cells and a few polymorphonuclear leucocytes. Congestion of the meninges is seen in the different sections. The nerve cells show chromatolysis in the frontal and central sections and in Ammon's horn. Shrinkage of the nerve cells is seen in the central section and severe cell change in Ammon's horn. The intracerebral blood vessels are congested, more marked in the white matter of occipital region. There is no focus of hemorrhage. Perivascular lymphocytic infiltration is slight or moderate, being more marked in the white matter of occipital region. The ependyma of the lateral ventricle shows no remarkable change.

Cerebellum: The leptomeninges contain a few lymphocytes. The meningeal vessels and the vessels inside the brain are congested, more marked in the white matter. No hemorrhage. There is slight perivascular lymphocytic infiltration in the white matter. The nerve cells show no remarkable change.

Basal Ganglia: Except for slight perivascular lymphocytic infiltration, there is no remarkable change.

Mid-brain, Pons and Medulla: The leptomeninges are slightly infiltrated by lymphocytes, mononuclears and a few polymorphonuclear leucocytes. Some of the blood vessels in the brain are congested, but there is no hemorrhage. Perivascular lymphocytic infiltration is slight. The nerve cells show no remarkable change except for eccentricity of nucleus and central chromatolysis in the region of superior central nucleus. There is no remarkable change in the substantia nigra.

Spinal Cord: Nothing remarkable.

Choroid Plexus Congested and edematous. There is slight infiltration of lymphocytes, mononuclears and a few polymorphonuclear leucocytes.

Note: Bacterial cultures of heart blood, brain, lung and spleen reveal no growth.

Pathological Diagnoses

Acute encephalitis.

Pneumonia of a peculiar type (left upper lobe).

Acute splenic tumor.

Cloudy swelling of liver and kidneys.

Fatty change of liver.

Congestion of kidneys.

Intestinal ascariasis.

Hu Cheng-hsiang, M.D., Professor of Pathology, China Union Medical College, Peking.

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Hsü Ying-k'uei, M.D., Associate Professor of Neurology and Psychiatry, China Union Medical College, Peking.

Wu Tsai-tung, M.B., Professor of Pathology, Medical College, Nanking University.

Lin Chen-kong, M.B., Professor of Pathology, Medical College, Peking University.

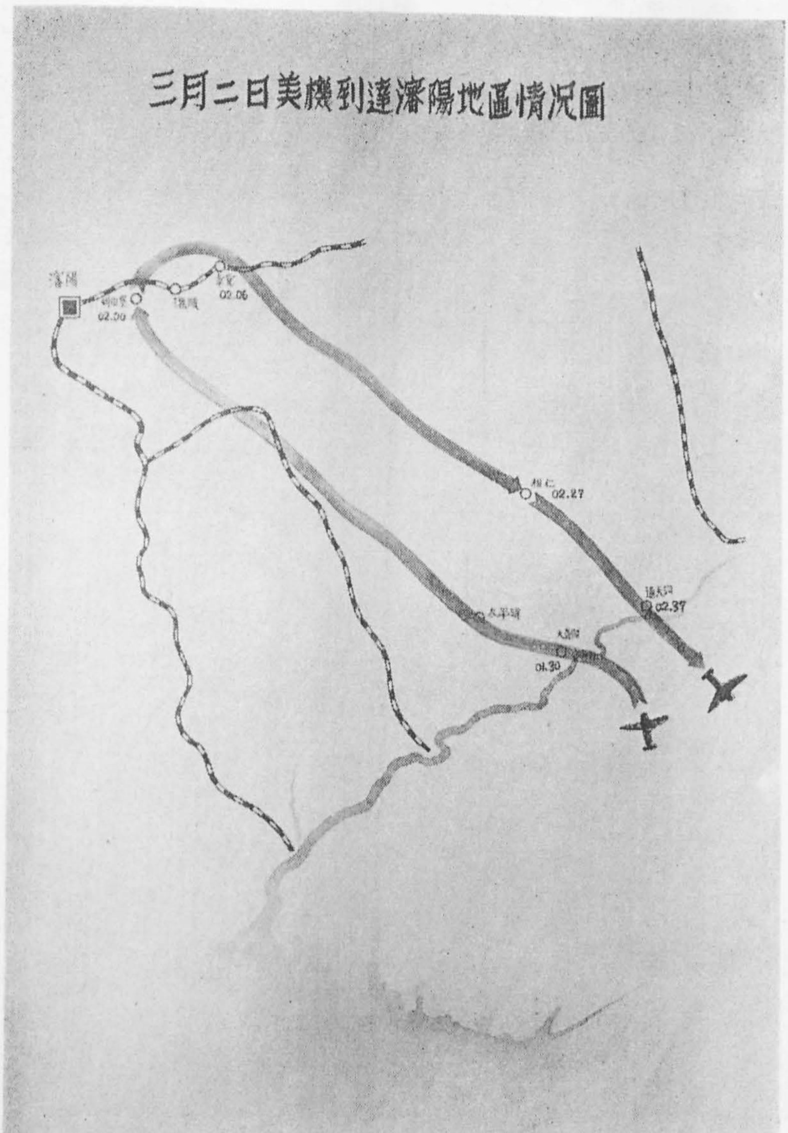

Fig. 1. Chart showing the intrusion over Shen-yang (Mukden) and its neighbourhood by American airplanes on March 2, 1952.

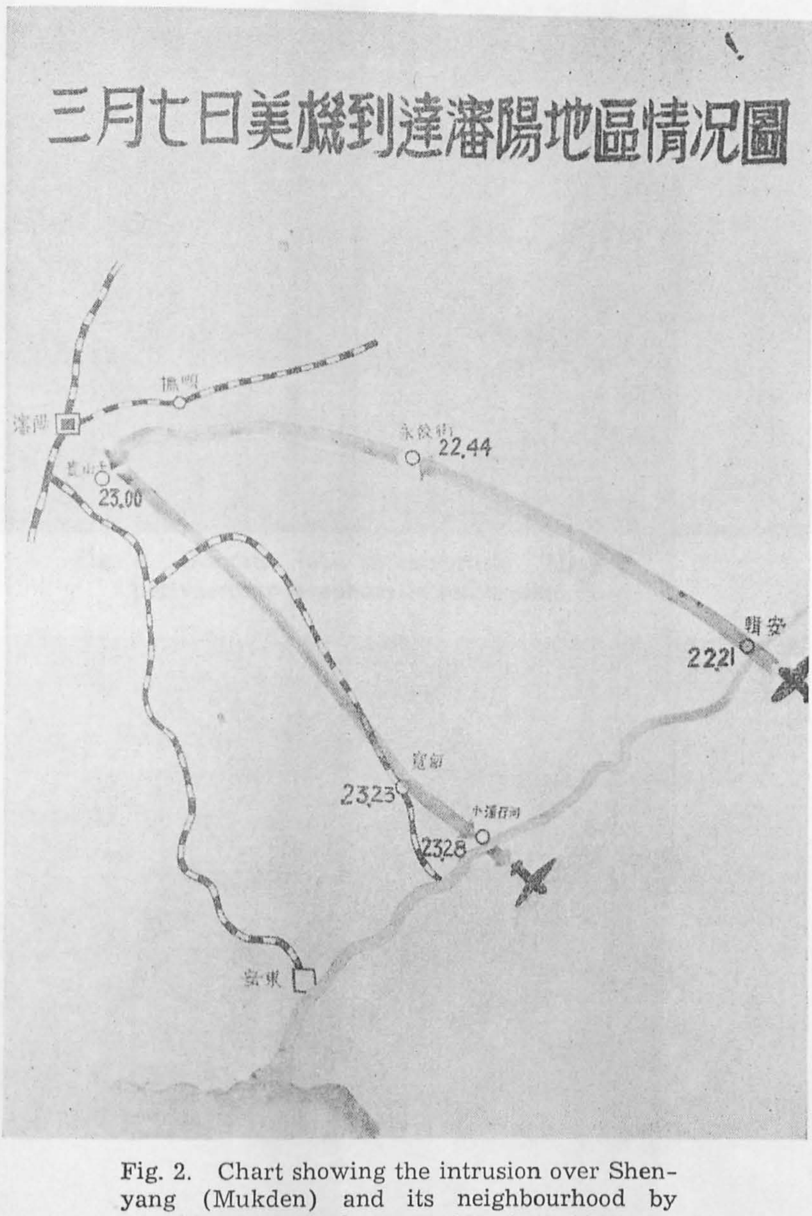

Fig. 2. Chart showing the intrusion over Shenyang (Mukden) and its neighbourhood by American airplanes on March 7, 1952.

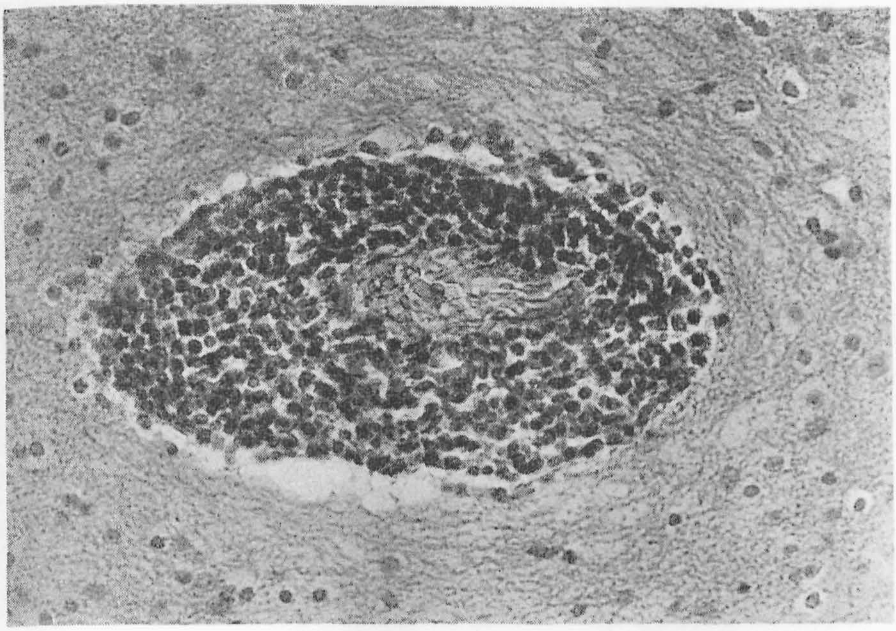

Fig. 3. Occipital lobe of cerebrum: Marked perivascular lymphocytic infiltration.

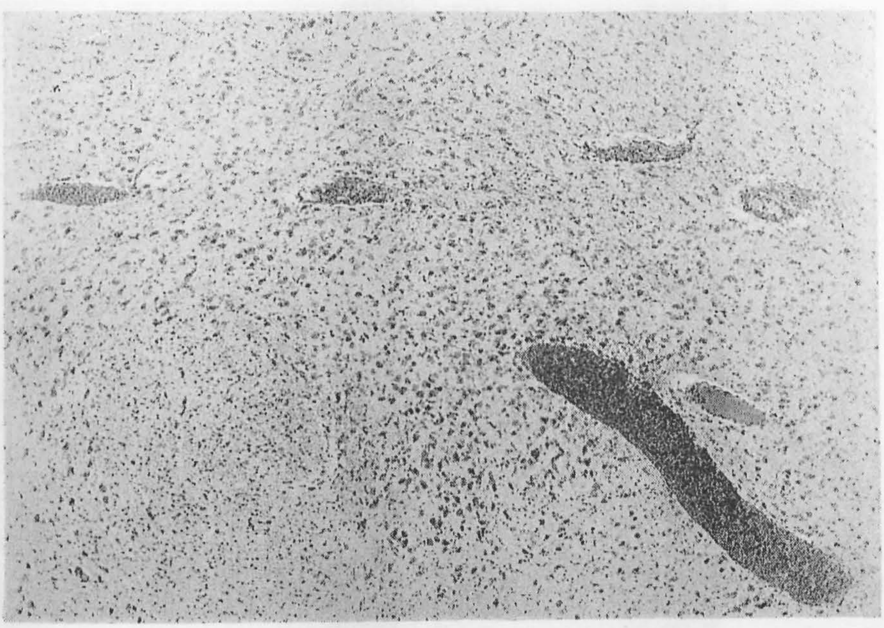

Fig. 4. Pons: Marked congestion.

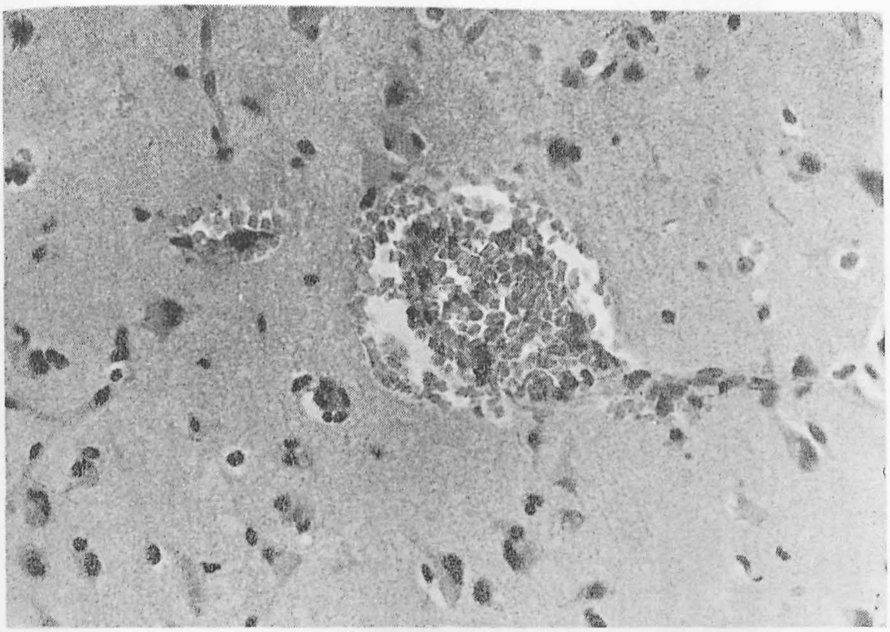

Fig. 5. Hippocampal gyrus: Perivascular hemorrhage.

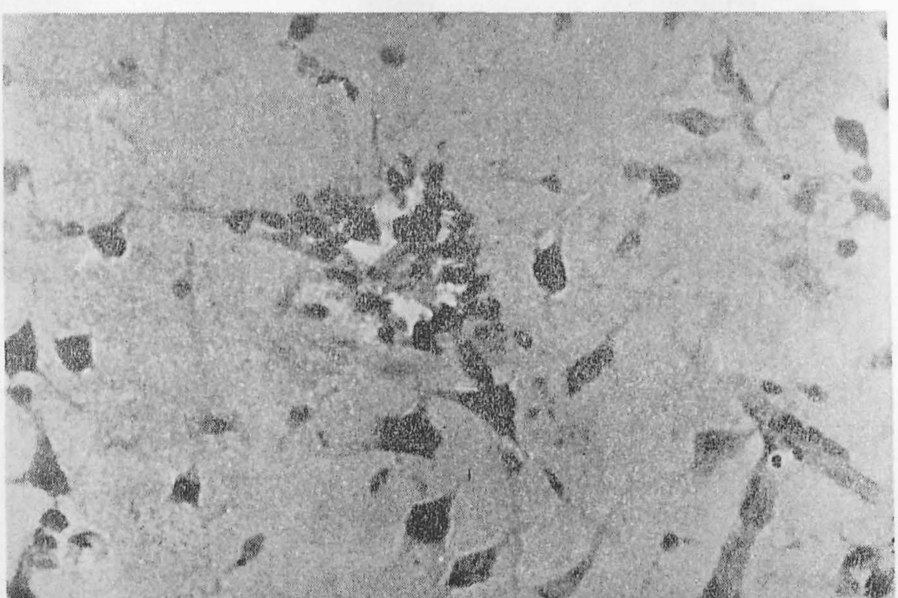

Fig. 6. Cortex of cerebrum: Neuronophagia.

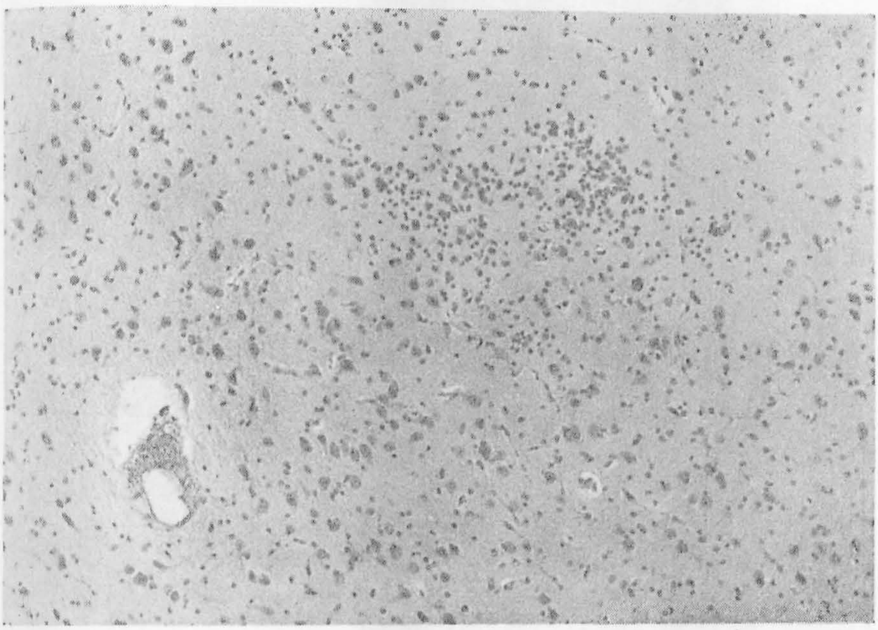

Fig. 7. Cortex of cerebrum: Glia nodule.

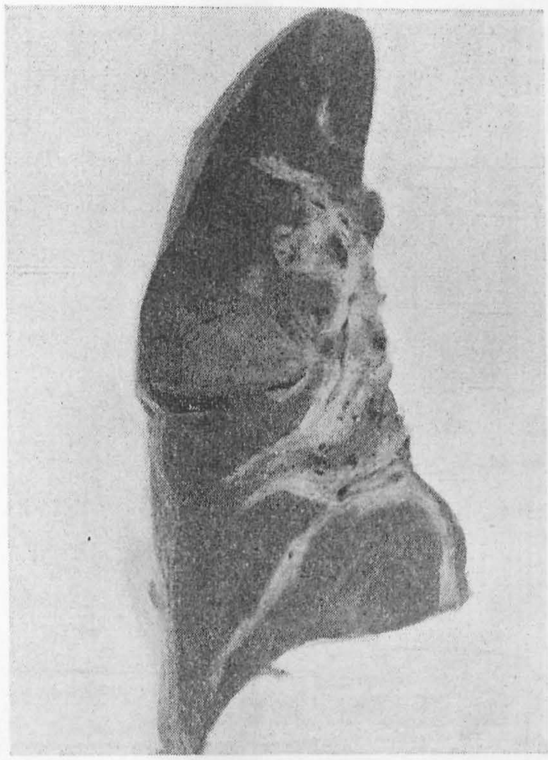

Fig. 8. Isolated and localized pneumonia of left upper lobe.

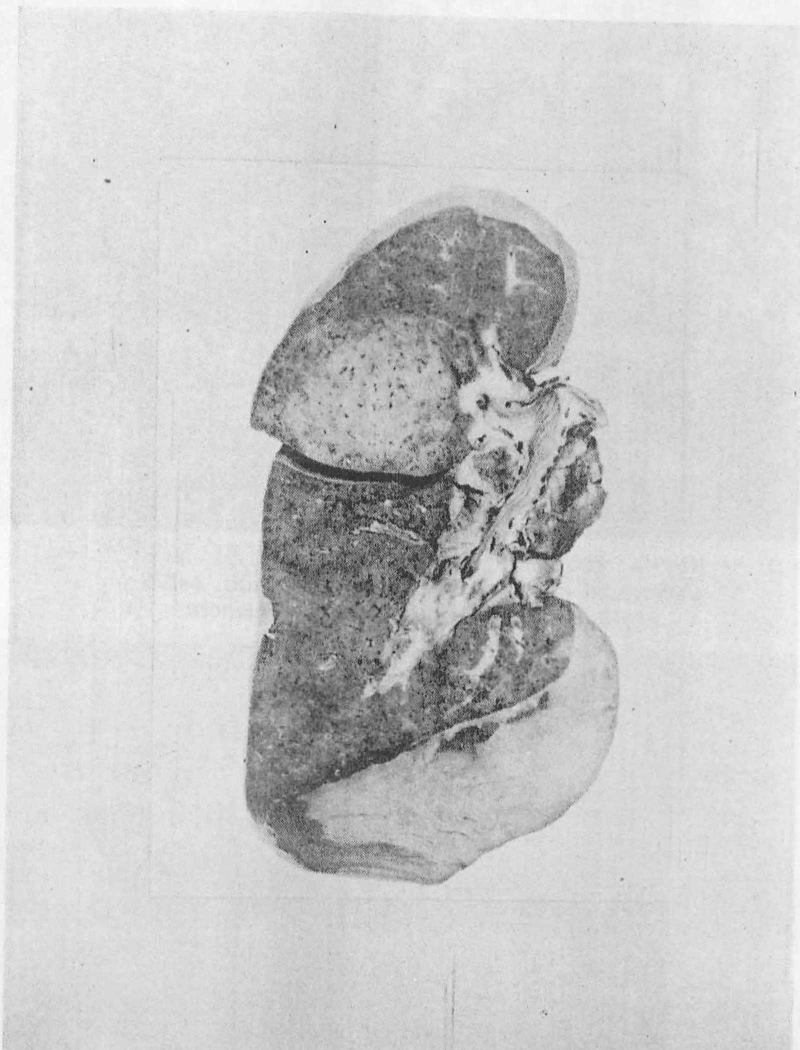

Fig. 9. Isolated and localized pneumonia of right upper lobe.

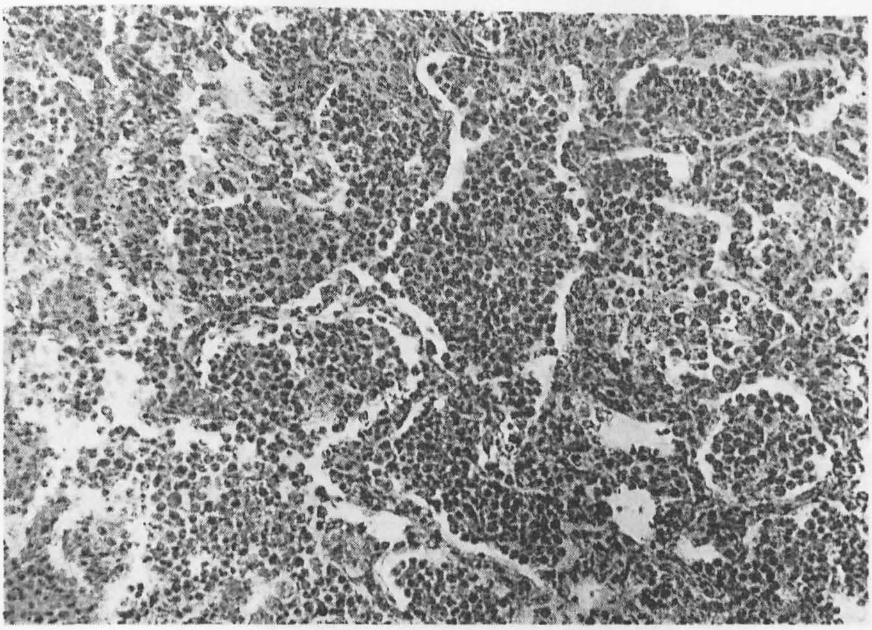

Fig. 10. Section showing pulmonary alveoli filled up with polymorphonuclear leucocytes, monocytes and a small amount of fibrin.

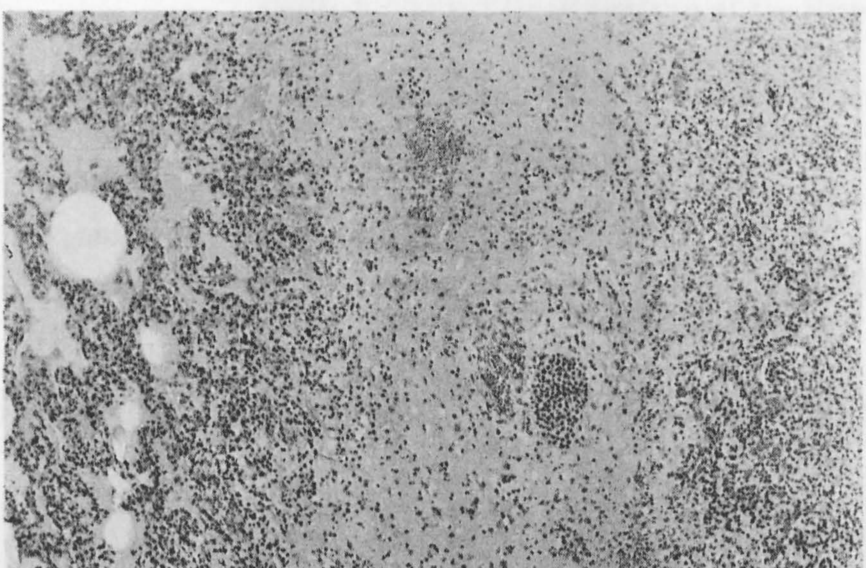

Fig. 11. Section showing interlobular fissures of lung markedly edematous, infiltrated by polymorphonuclear leucocytes and containing small hemorrhages.

APPENDIX GG

Hearings on the Cases of a New Form of Encephalitis Occurring at Shenyang (Mukden) After American Air Intrusions

July 24th, 1952

Dr. Pai Hsi-ch'ing (Vice-Minister of Health, People's Government of Northeast China, representing the assembled specialists).

(A) The total number of cases which have occurred can not be deduced from any statement in the Report. Numbers given are only autopsy serial numbers. However, cases are still continuing.

The overall fatality rate may be said to be higher than that of the Japanese B type and lower than that of the Eastern equine type.

It was confirmed by Dr. Chu Chi-ming that of all the important types of encephalitis virus with which it had been possible to make serological tests for the study of the etiological agent of the new type of encephalitis, only the Eastern equine had been unavailable.

(P) The neurotropic virus obtained from the crane-flies had turned out to be quite different from any human encephalitis virus. Inoculation into monkeys had not been tried.

(N) The reason for the original connection between the crane-flies and the encephalitis cases had been purely chronological coincidence. They had been found in large numbers near a pumping station (which had no open reservoirs or other water surfaces) at a village near Anshan just before the first cases began to come in, and after American air intrusions.

(O) Admittedly, the connection with these planes was doubtful, as no containers had been seen to fall.

(Z) Concerning the encephalitis and pneumonia, it was very hard to be sure what was the primary site of attack until the aetiology of the disease was clarified. It was either the lungs or the brain.

(A) The difficulty of identification with the Eastern equine type (encephalomyelitis) was that, as Dr. Hsü Ying-K'uei had pointed out, there was in none of the cases studied any feature characteristic of that type in the spinal cord, brain stem, basal ganglia and cerebral cortex.

APPENDIX HH

Information on Arthropod-Borne Diseases of the Encephalitis Type in Man

"The outstanding points of similarity of one member of the group of arthropod-borne diseases of encephalitis type to another are the clinical and pathological pictures, for no practical classification based on these features can be made.... Other points of similarity are that the viruses of this group are mostly of the same size, about 20-30 millimicrons in diameter..... The clinical and pathological pictures are, then, indicative only of an encephalitis; the differentiation of the various members into specific types is possible only through laboratory investigations which combine the isolation and identification of the virus, and serological and immunological procedures." (Casals & Olitsky).

In what follows, the main features of the different forms of this disease will be tabulated.

1) Russian Far East (Spring-Summer) Encephalitis.

"For the past forty years at least, there has been recognised an epidemic type of human encephalitis, occurring annually in the forest regions of the eastern USSR." (Hammon).

Date of isolation of virus 1937

Season	Spring and early summer, coinciding with the activity of ticks.
Region	Eastern forest regions of USSR.
Vector	Tick (*Ixodes*).
Reservoir	Tick, with transovarian passage.
Average Mortality	About 30%.
Clinical Remarks	The disease differs from the rest of the group principally with regard to paralytic manifestations. Shoulder-girdle paralysis or paresis is reported to occur quite frequently.
Vaccine	A formalinised tissue vaccine is effectively used to protect man in the regions involved.

2) Japanese B Encephalitis.

Small epidemics have occurred in certain districts in Japan since 1901 or even earlier. The first great epidemic took place in 1924. The malady was named Encephalitis B to distinguish it from Encephalitis lethargica or von Economo's Disease (A).

Date of isolation of virus	1934-5
Season	Sharply limited to the late summer and early autumn, ending with cool weather.
Region	All Japan, but no cases reported from Northern Islands.
Vector	Mosquitoes. *Culex tritaeniorhyncus* and *Culex pipiens* var. *pallens*. The virus has also been isolated from *Anopheles hyrcanus* and several species of *Aedes*.
Reservoir	Not clearly defined. "This virus may have many temporary reservoirs. Domestic animals, horses and birds have all been mentioned" (Hammon).
Average Mortality	50% or more.
Age Incidence	In early epidemics, the incidence of the disease increased steadily with age, but since 1935 it predominantly affects children and elderly people.
Clinical Remarks	Incubation period 1-2 weeks. A vaccine prepared from mouse brain has been in use.

3) Chinese (Summer-Autumn) Encephalitis.

Isolated cases have occurred in China since 1921. Between 1936 and 1951, epidemics have occurred practically every summer. Chao & Chung, on the basis of 229 cases observed by them in Peking between 1942-51, give the most prevalent symptoms as shown below.

Date of isolation of virus	1941 and 1949-50. Identical with Jap-B.
Season	Late July onwards; peak third week of August.
Region	Geographical distribution about 22-42° lat. N. (Canton to Shenyang).

Vector	Probably *Aedes chemulpoensis.* Other species of mosquitoes of this genus likely to be involved (Huang et al).
Reservoir	Unknown, perhaps dogs or horses.
Average Mortality	25 to 50%. Much lower in children.
Age Incidence	Mostly under 30 yrs. of age (80%). Increasing natural immunity with age.
Clinical Remarks	Fever 100%; headache 74%; nausea 54%; convulsions 37%; comatose state 34%; drowsiness 33%; incontinence 29%.
Vaccine	A vaccine prepared from mouse brain has been developed and has been in use since 1951, especially for school children.

In 1952 the number of cases occurring was half that of 1951 and the fatality rate of 1950 was nearly halved in 1951 (40.6% to 26.8%).

4) St. Louis Encephalitis.

This disease made its first appearance in 1933 in and around St. Louis, Mo., USA. It is now endemic in North America. Epidemiologically it is very similar to Japanese-B.
Date of isolation of virus 1933 and 1941

Season	Limited to the warm season, July, August, September.
Region	38-40° lat. N.
Vector	Mosquitoes, among which *Culex tarsalis* and *Culex pipiens* are considered established. But the virus has also been isolated from *Aedes dorsalis* and from five other species of this genus, from four other *Culex* species and from two *Culiseta*.
Reservoir	Unknown. The two established vectors feed, however, predominantly on fowls. But chickens and other birds show no ability to serve as chronic carriers. The reservoir might be vertebrate or arthropod. *Dermacentor variabilis,* a dog tick, has been shown, when experimentally infected, to be capable of transmitting the infection,

	and transovarian passage has occurred. *Dermanyssus gallinae*, a chick mite has been shown to carry the virus. Mites and ticks are of the same Order, and trans-ovarian passage is well known among them—they may well be the reservoir.
Average Mortality	On the whole low in comparison with other forms—5-30%.
Age Incidence	Susceptibility increased strikingly with age in the early outbreaks.
Clinical Remarks	No peculiarities.
Vaccine	None.

5) Western Equine Encephalomyelitis.

Equine encephalomyelitis seems to have been present in North America for many years among horses and mules. It has been misdiagnosed as botulism and other diseases. The western type seems to give rise only to occasional cases in man, as no epidemic is on record. According to Hammon the epidemiology and the clinical manifestations in man appear to be practically identical for the Western Equine and the St. Louis type.

Date of isolation of virus	1931
Season	Summer months.
Vector	Probably chiefly *Culex tarsalis*. Western equine virus is isolated most frequently from this species, but it has also been obtained from *Aedes dorsalis, Culex stigmatosoma, Culex pipiens, Culiseta inornata,* and *Dermanyssus gallinae*.
Reservoir	According to Hammon the problem of the true reservoir or method of carrying over from season to season remains unsolved. The role of ticks is also still obscure. Fowls seem to be an important source of the mosquito infection. Of the *Aedes* 98% feed on mammals of one kind or another. It seems likely that the vertebrate hosts and possibly the invertebrate vectors differ from one area to another.
Average Mortality	According to Fothergill, 25-30%.
Clinical Remarks	Similar to the St. Louis type.

Vaccine	A formolised chick-embryo vaccine is available for the prevention of the disease in equine animals (Beard et al 1940).

6) Eastern Equine Encephalomyelitis.

An epidemic among horses occurred in 1933 in Virginia and New Jersey. There was another epidemic among horses in 1938 in Massachusetts. During this time and in the same area there was an outbreak of acute and highly fatal encephalitis in children.

Date of isolation of virus	1933 (horses).
Season	Late August, early September (1938).
Vector	According to Fothergill the eastern and western types do not differ in transmission though the viruses and clinical pictures are quite distinct. *Culex tarsalis* and diverse *Aedes* are the vectors.
Reservoir	The malady, according to Fothergill, is primarily a disease of birds; man and the horse are accidental secondary hosts. He points out that Sylverton & Berry showed that the tick *Dermacentor andersoni*, could be infected by feeding on an infected animal, and could then pass on the infection to succeeding generations.
Average Mortality	65%, for children 90% (1938).
Age Incidence	Decreasing with age; 70% of the cases in the 1938 outbreak were less than 10 years of age.
Clinical Remarks	Fothergill gives the clinical picture as follows: sudden onset, temp. 103-105°F., repeated convulsions, deep coma, stiffness of the back, death in fatal cases most common during the first few days.
Vaccine	Formolised-inactivated vaccines prepared from infected chick embryos have been used successfully for prevention of the disease in equine animals.

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APPENDIX II

Commentary on the Incidents at Shenyang (Mukden) (Encephalitis)

The study of the material furnished by the Chinese health authorities on the cases of encephalitis at Shenyang (Mukden) invites the hypothesis that the American air forces here used aerosols of some virus, according to the more "up-to-date" methods worked out in the laboratories at Camp Detrick and other bacteriological units of the armed forces. The theoretical basis of this kind of bacteriological warfare has been stated by the American invesigators in connection with their studies of accidental laboratory infections. It has led to the opinion that it is possible not only to infect human beings by way of the respiratory tract with agents which in natural conditions are disseminated only by insect vectors, but also to induce all kinds of infections by means of aerosols containing particles of known size, even when the usual portal of entry to the body is through the intestinal tract.

The fate of an aerosol particle after inhalation varies according to its size. Those of diameters larger than 4 to 5 μ are filtered out in the upper bronchial passages, the ciliated epithelium of which carries them back so that they are finally ingested. Those about 1 μ in diameter arrive in high percentage in the pulmonary alveoli, and can be removed only by the mechanism of phagocytosis. In such cases the leucocytes themselves become the carrier of the particles, and of any micro-organism which they may engulf, so that these pass into the blood through the lymphatic system, and finally reach different organs. Thus it will readily be understood that some diseases normally transmitted by vectors can be transmitted by aerosols if their particles are sufficiently small, while others, which normally enter by the intestinal route, can also be transmitted by aerosols if their particles are suitably large.

Such are the theoretical foundations for the opinions of Rosebury and others regarding the more "rational" methods of bacteriological warfare, which would consist in the use of aerosols of bacteria, viruses, or toxins, classified according to particle-size. In the American literature it is possible to see considerable "progress" in the use of

these aerosols both from the theoretical point of view (particle-size) and from the practical (selection of strains particularly well adapted for this method).

Incident Analysis

The scheme of analysis elsewhere proposed and adopted for elucidating presumed bacterial attacks is not well conceived for dealing with the dissemination of pathogenic agents by aerosols. In the first place no kind of container or bomb will be found; no insect or other vector will appear; the aerosol will be invisible; and fourthly laboratory demonstration will be extremely difficult if a virus is being disseminated, all the more so when the investigators do not know what to look for. The methods to be adopted will necessarily be different. There will be epidemiological arguments, the character of the disease, the types of lesions occurring, and the characteristics of the pathogenic agents employed. Besides these evidences, the admissions of captured pilots must not be forgotten. It should be possible to reach conclusions no less well founded than those arrived at in the body of the Report for other methods of biological warfare.

General Characteristics of the Disease at Shenyang.

1) Time Distribution of the Cases.
The first case was seen on the 10th. March. The maximum number of new cases occurred in the first ten days of April. By the end of April there was a marked decrease. The incident therefore had a fairly rapid rise and slow decline, with a limited total duration.

2) Distribution of the Cases in Space.
The cases were distributed all over the city and its suburbs without any tendency to concentrate in focal points. This fact, together with the established absence of any connection between the cases, demonstrates that they were independent of one another and yet brought about by a factor common to all.

3) Season.
In Northeast China encephalitis of the Japanese B type (see App. HH) is endemic, but it occurs typically in summer and autumn. This circumstance, together with others to be mentioned shortly, excludes the possibility that the Shenyang disease is identical with this.

4) Plane Intrusions.
It was established that there were American air intrusions over Shenyang, on the 2nd, 7th (twice), and the 13th March.

5) Clinical Symptoms.

a) The brief duration of the malady, the absence of involvement of the external pyramidal tracts, and the absence of paralysis of the oculomotor nerves, distinguish the disease from encephalitis lethargica.

b) The absence of bulbar and/or spinal symptoms distinguishes it from acute anterior poliomyelitic form of encephalitis, also from the equine forms, and the Russian spring-summer form, of encephalitis.

c) The presence of disturbances of consciousness, and the high mortality rate, distinguish it from lymphocytic chorio-meningitis.

d) The patients, whether they died or lived, never showed clinical symptoms of lung involvement.

6) Laboratory Findings.

a) The complement-fixation reaction excluded identity with Japanese B encephalitis.

b) Other arthropod-transmitted forms of encephalitis were also excluded by the same serological test.

c) The virus was not pathogenic for guinea-pigs (intra-cranial route) or for white mice (intracranial, nasal, and peritoneal routes).

d) It was not possible to isolate the virus by inoculating it into either the amniotic cavity or the yolk-sac of the chick embryo.

e) Attempts to make bacterial cultures from the heart blood and brain tissue of the eleven cases which came to autopsy, failed.

f) Pneumococci were sought in the pulmonary lesions of nine cases, but were found only in three.

g) Pneumococci were found in the spleen in one case only.

7) Anatomical and Histo-Pathological Findings.

a) No significant changes of the spinal medulla could be seen.

b) In eight out of the eleven cases coming to autopsy, there existed in each patient only one single pulmonary lesion of the type of an acute pneumonia with haemorrhagic periphery and scanty fibrinous exudate, and took the form of a nodule of diameter from 2-4 cms. Lung lesions were not found in the remaining three.

c) Microscopically the brain lesions observed chiefly consist of perivascular lymphocytic infiltration, congestion, haemorrhage and degeneration of nerve cells. A limited amount of infiltration into the meninges could be observed.

d) The pulmonary lesions showed mainly involvement of the alveoli with infiltration and oedema of the interlobular septae and the presence of a sparse fibrinous exudate.

Observations and Conclusions

The character and distribution of the brain lesions, the clinical symptoms, and the anatomical, pathological, and epidemiological data, show that the Shenyang disease was a form of encephalitis different from all those previously known.

The fact that in eight cases out of the eleven which came to autopsy only one single pulmonary lesion was observable in each, leaves little doubt that the respiratory tract was the portal of entry of the pathogenic agent, and the pulmonary lesion was not just a collateral manifestation of a generalised morbidity. Otherwise one would have expected to find in the patients' lungs a distribution of lesions corresponding to Poisson's Law. A statistical test (see Table) shows that the probability of finding the single lesion seen would be as low as 2-5%. It is not improbable that we have to deal with a virus capable of multiplying in the lung as well as in the brain. In this case the lung lesions would be the centre of multiplication of the virus, which would thence be rapidly transmitted to the brain. Thus one single virus particle could in a short time give rise to a lethal encephalitis.

The lack of any connection between the cases, the brusque onset and short duration of its prevalence, the extreme virulence of the aetiological agent, its probable aerial diffusion, the presence of American airplanes over Shenyang in chronological association with the disease, the unprecedented nature of the syndrome in the area—all these circumstances indicate the artificial spreading of this disease for war purposes on the part of the American armed forces. And to this must be added the testimonies of the captured airmen concerning the intention to use spraying methods, the intention to use encephalitis and the actual equipment of planes with apparatus for diffusing aerosols (App. LL & MM).

This conclusion is supported by what is known of the researches conducted at Camp Detrick and by the American Navy on the possibility of infections by clouds of bacteria and viruses consisting of droplets of known size.

Table

Symbols	*Logs*	*Values Expected*	*Values Found*	*Deviances*
n = 11	1.04139			
e^m	0.31574			
n/e^m	0.72565	5.317	3	— 2.317
m = 0.727	$\bar{1}.86153$			
mn/e^m	0.58718	3.865	8	+ 4.135
m	$\bar{1}.86153$			
m^2n/e^m	0.44871			
2	0.30103			
$m^2n/2e^m$	0.14768	1.405	0	— 1.405
m	$\bar{1}.86153$			
$m^3n/2e^m$	0.00921			
3	0.47712			
$m^3n/(2)(3)e^m$	$\bar{1}.53209$	0.3405	0	— 0.3405

Number of lesions	*Expected*	*Found*	*Deviances*	*(Dev)2/Expected*	*P*
0	5.317	3	— 2.317	1.010	
1	3.86	8	+ 4.135	4.424	2–5%
2	1.405	0	— 1.405	1.405	
3	0.3405	0	— 0.3405	0.3405	

Cf. G. V. Snedecor, "Statistical Methods", Iowa State Coll. Press, 1948.

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APPENDIX JJ

Notes on the Case of the South Korean Agent Sent to the Northern Part of Korea to Collect and Transmit to American Headquarters Epidemiological Intelligence

The agent, *Lim Choon-Tack* (age 25), was presented to the Commission by the Korean Minister of Health, Dr. Ri Ping-Nam, (30th July, 1952). He made the following statement:

By occupation he was a peasant-farmer, working a farm with his grandparents.

In 1943 he had left the Middle School of Onjin.

In 1945 he joined the South Korean "Youth Organisation".

When the North Korean army first came to his village, he was forbidden to go south, so he continued to work on the farm. When the American forces returned, he rejoined the "Youth Organisation," and continued agricultural work. In Dec. 1950, when they retreated once again he went with them, and for a time lived on one of the islands off the coast doing nothing in particular. Then he was recruited to the intelligence service of the 8th U.S. Army.

In Oct. 1951 he was transferred to an expeditionary corps on another island, and continued intelligence training. In Dec. 1951 he was sent, together with ten other young men, to Seoul, where he worked at the staff headquarters of an organisation called "K.L.O." He never knew the significance of these letters. After a while all the men were interrogated, and all of them except himself were sent back where they had come from.

His training was then continued until Mar. 1952.

He was told that information was needed in the military, economic, political and cultural fields. He was urged to remember the importance of the "Six Questions": when?, where?, who?, what?, how?, and why?. He was instructed how to organise a network of "cells", the relations between which must be vertical and not hori-

zontal. Private talks between agents were never to exceed 20 minutes.

In Feb. 1952, he received injections every 3 or 5 days. An American major then told him, through an interpreter, that he was assigned to very important work—he was to go into North Korea and check up on the occurrence of infectious diseases, working in Huang-Hai Province but gathering information from as far afield as possible. The Americans were particularly interested, he was told, in *typhoid, plague, cholera, encephalitis, dysentery, and small-pox.*

He would find that the best way to accomplish his task would be to get into contact with small provincial officials, and particularly personnel working in the health, sanitation, and epidemic prevention services, not forgetting nurses; and to choose those who were weak in their political convictions. He was to set up some intelligence cells among them if possible, and in any case to get analysed statistics of morbidity and mortality in North Korea, stealing them if necessary.

He was given a flashlight, two hand-grenades, and North Korean money equivalent to about US $1,000. He was also furnished with forged North Korean papers purporting to emanate from a Village People's Committee, as also the requisite vaccination certificates.

He was told to be careful about food, but that he was well protected by the inoculations which he had had. He was given a small supply of drugs, and warned not to sleep in any place where there were fleas or bugs, nor to drink unboiled water. If he drank tap-water he was to smell it first.

He would be working, he was informed, with a companion who had a portable radio set, and who would be responsible for transferring the information.

On the 28th, Mar. he left Seoul by truck for Inchon, and was then taken by motor-boat to an island, where he was introduced to Li Yung-Pe, the radio operator.

They quickly crossed over to the mainland.

He then went home first for one night, and afterwards made his way to a mountain, Cham-Nam San, which had been designated by his HQ as suitable for the radio post. The base was set up in due course, and HQ was informed of this on the 31st.

Next he made a trip to Onjin to collect helpers, but he knew of only three suitable people who had formerly been members of a "security corps" organised by the American forces. These men he could not contact as they had gone away on epidemic prevention work.

From time to time he read public notices about bacteriological warfare, but though he travelled a good deal, he could not get the helpers he wanted.

He informed HQ through the radio operator that strong measures were being taken against epidemics in North Korea. Messages came back urging him to produce more results, but he was quite unable to accomplish much.

On 20th May he went to Hae-Ju, and shortly afterwards was arrested by police who happened to be in a restaurant which he went into, and who thought he seemed a suspicious character.

The Minister of Health stated that this witness now came before him for the first time, and said that he would like to put a question himself before handing the examination over to the Commission.

(Min) He could not say what exactly were the injections which he had had. They did not make him feel ill. Some were done on the back and some on the upper arm. The major told him he would be fully protected.

(A) No, he had definitely not known before he came over into North Korea that the Americans were carrying on bacteriological warfare. He had only heard in South Korea that they were using "very modern scientific weapons" and that they had had good results. After he came to the north, he saw the public notices, and talked with men who were working in the epidemic prevention services; this convinced him about what was happening.

(M) The reason why he had joined the intelligence auxiliaries of the American forces was partly by conviction. When formerly he had lived in South Korea he had been a member of the "Youth Organisation". Without being very clear about North Korean ideas, he had always believed in South Korean policies, and understood that land reform had been carried out in North Korea. He and his grandparents owned a fair amount of land (though the Commission could not ascertain that it was more than 4 hectares), though not more than they could work themselves, together with 1 ox and 1 pig. He was afraid that these things would be taken away from them if land reform took place. In general he had always been against the communising government of North Korea, so he was frightened when their troops came, though nothing terrible happened. Eventually, however, his motive in joining the auxiliary intelligence service had been in order to eat, since on the island where he went he could find no other work to do.

He could not describe himself as having any special religion.

The radio operator had not yet been captured. He remained on the mountain.

After he (Lim) was captured he waited a week before he revealed where the radio base was, because it had been agreed between them that if a week passed without news, the radio man would know that he had been arrested, and would accordingly disappear.

Yes, he had been on the whole well treated since his capture, especially considering that he had come into the country as an enemy agent.

He could not say how similar agents were treated on the other side, if captured.

Since his arrival in North Korea he had had a chance to see the farming there and compare it with the south; his opinion was that it was definitely better in the north, perhaps because of the land reform.

(N) He still had no idea what the letters KLO had stood for. (Perhaps "Korean Liaison Organisation.") He did not know why his ten companions had been sent back, presumably for some reason or other they did not have the right qualifications for this kind of assignment.

He did not know what to think about North Korea. He found it difficult to estimate the effects of the land reform. His grandfather told him that the North Korean government had confiscated land without compensation, but that the great majority of the people were extremely pleased about it.

He himself however was not prepared to give an opinion.

As to the number of injections which he had had, he thought it was about 20. Some of them gave him fever, and some gave him hard nodules in the muscles which he was told to massage.

He did not know, and had never heard, the name of the American major, but would be able to recognise him if he saw him again.

This was the only American he ever met directly; all his instructors were South Koreans.

(O) He knew no English.

By the time of his capture he had been able to spend only a small amount of the money with which he had been provided. It was a considerable sum, most of which had been intended for bribes.

(C) As to how he felt after he had become convinced that the Americans were carrying out bacteriological warfare, he certainly felt bad, and his conscience reproached him, but he did not know what else to do except to try to live through it somehow until peace came.

He had let the radio operator escape because that was an order he had received from his superiors, and he still felt some sense of loyalty to the South Korean government.

As for himself, he no longer cared whether they got the information they wanted or not, and hoped that the HQ would soon realise that he had been captured.

In conclusion, the Minister explained that the "Youth Organisation" to which the witness referred, was a well-known terrorist organisation. The drugs which the witness had brought with him were exhibited. It should perhaps be added, with all due reservations, that the witness impressed the Commission personally as a not very high or intelligent type.

APPENDIX KK

Testimony of Lt. K. L. Enoch Concerning His Participation in Bacterial Warfare Waged by the American Forces in Korea (SIA/14)

The Truth About How American Imperialism Launched Germ Warfare

I was at Iwakuni, Japan, during the last two weeks of August, 1951. During the month of August the 3rd Bomb. Wing was in the process of moving to Kunsan, Korea, and the last thing to make the move was the ground school which moved on to Kunsan in early September, 1951. During my stay at ~~Kunsan~~ Iwakuni there were about 15 crews which had just come from the United States and were attending the ground school. This ground school gave the same kind of classroom subjects as the school at 4400 CCTG. We navigators recieved lectures and problems in navigation and the B-26 and Korea, so we would understand our jobs better and thus be better equipped to fly in combat.

On 25 August, 1951, at 1300 hours, we attended a secret lecture in the ground school navigation classroom. There were as I recall, 10 pilots and 15 navigators present at the lecture. Of the pilots I recall Lt Broughton, Lt. Schmidt, and Capt. Lemak. Among the navigators I remember Lt Brown, Lt. Hardy, Lt DeGaugh, Lt. Zielinski, Lt Garvin, Lt. Larson, and myself. I did not know all the pilots and navigators, only those I had been with at Langley Field. Our instructor's name was Mr. Wilson, a civilian. There were no other instructors in attendance at this lecture

Mr. Wilson told us that his lecture was concerning bacteriological warfare. He told us that our side had no plans at that time of using bacteriological warfare, but never-the less we might at some time, and thus the lecture was secret information and we were not to divulge its contents to anyone, ~~ore~~ or even talk about it among our selves.

The main part of Mr. Wilson's lecture was devoted to the weapons of bacteriological ~~weapons~~ warfare. He did not have any examples with him, but he discussed the various methods of scattering germs, either by scattering the germs by themselves or by dropping insects and animals to spread the germs.
The contents of Mr Wilson's lecture is as follows:

The ways of dropping the germs by themselves are: ① by dropping a bomb full of dust and germs mixed together, which will open in the air and spread the germ-laden dust with the wind; ② by dropping dust directly from the airplane itself, by means of a spraying device, so that there will be germs in the air wherever the dust is sprayed; ③ or by dropping a container full of germ dust, either a bomb which will open in the water or a paperboard box which will be opened by the water, into reservoirs and lakes where the people and animals use the water, and where insects will pick up the germs and spread them.

The ways of dropping insects are: ① by dropping a germ bomb which looks just like an ordinary bomb, but is filled with germ-laden insects, and which will open on contact with the ground to release those insects; ② by dropping insects in paperboard containers which will break open on contact with the ground, releasing the insects with their germs; ③ or by spreading insects with animals.

The ways of releasing germs by animals are: ① To release the rats or ~~rabits~~ rabbits or small game by a parachute container which will release the animals upon contact with the ground, and these animals are covered with germ-bearing lice and fleas; ② or by releasing such animals from a boat behind the enemy shoreline.

There are other ways of spreading germs also: ① By dropping leaflets toilet paper, envelopes, and paper materials which have been covered with germs; ② by dropping germ-filled soap or clothing; ③ by dropping fountain pens filled with germ-laden ink; ④ or by dropping infected food to the enemy troops.

You can also spread germs by howitzer or mortar shells, but since it is so close to the front it is not safe to do so

There are many types of germs that can be spread. In addition to many weird and unusual germs, the germs of more well-known diseases, such as typhus, typhoid, cholera, dysentery, bubonic plague, smallpox, malaria, and yellow fever may be employed. There are many types of insects to carry these germs, the most popular being the louse, flea, fly, and mosquito. The louse can carry typhus, cholera, smallpox, plague, and dysentery, as can the flea and the fly. The mosquito can carry malaria, and yellow fever.

The best way to defend against germ warfare is to be prepared. All possible people should be inoculated against all diseases possible. If insects are dropped, it is advisable to pour kerosene or oil on the containers they are dropped in and set fire to them. If they have already escaped from the containers, it is best to spray DDT over the area, preferably from an airplane. In case germ-laden dust is employed, DDT spray must be used. All exposed food must be disposed of. All exposed clothing and articles must be washed with hot water and strong soap. All water must be boiled. All food eaten must be thoroughly cooked. You must use some protection over your nose and mouth to breathe, and you must, when everything else is done, change clothes and take a good bath. All trash and waste exposed to germs must be burned. Screens should be placed on all windows in the summer for insect protection. In all cases, small animals such as rats should be destroyed so the danger of plague, which they spread with their fleas, will be lessened. If paper objects or other such items are dropped, they should be burned at once.

All weapons of bacteriological warfare are of such a nature that they should, when employed, be dropped from as low an altitude and as slow an airspeed as possible, to avoid harm to the insects. If parachute-type weapons are used any altitude will suffice but it should be sufficiently low, say 1000 feet, so that the parachute will not drift from the target area.
When Mr. Wilson had finished his lecture it was 3 o'clock (1500 hours) and he reminded us not to discuss the weapons subject to anyone and took his leave. This was the only such lecture we ever received. On September 1st, 1951, I went to Kunsan.

In October, 1951, and again in December, 1951, a one-hour lecture was given at Kunsan by a Major Browning on protection against germ warfare. This lecture he gave many times on each occasion, and every person was required to attend one hour's lecture. He gave the same lecture in December as in October. The idea, of course, is that due to the rotation plan there are always new troops, and it is also good to keep in mind the contents of his lecture. He told us that it was not unreasonable to expect bacteriological warfare to be used against us by the enemy. If they did, germ dust or germ-~~[illegible]~~ laden insects would be used, and he stressed that we should keep our shot records, or inoculations, current and up-to-date, and also discoursed on the other pertinent data as I have discussed in the second paragraph on page 3 of this paper.

On the 1st of January, 1952, we were told by the operations section group briefing officer at our regular briefing to be sure and report all our duds and where they fell. This was a usual procedure and just seemed to be a casual reminder at that time. The reminder was given to all the crews at the briefing by Capt. Carey, the group briefing officer. Due to a head cold I did not fly that night, but was replaced by another navigator.

My next scheduled flight was on the night of 6 January, 1952. We were scheduled to fly on Green 8 route (between Pyongyang and Sariwon), and our take-off was scheduled for 0300. The crew was Capt. Amos, pilot, myself, navigator, and Sgt. Tracy, gunner. As usual Capt. Amos and I reported to the group briefing room and group operations office at 0200 an hour before take-off. There we always checked for the latest weather and information on the mission to be flown. On this night we were informed by the officer on duty, a captain I am not familiar with, that we were to fly to the town of Hwangju and drop our outboard wing bombs (of which there are two) and then to drop the rest of our load as quickly as possible and come directly back to Kunsan. He told us to drop at Hwangju at 500 feet of altitude and 200 miles per hour maximum airspeed. We called his attention to the low altitude, as we were to carry 10-500 pound bombs according to briefing, but he told us that this was top secret and that these were germ bombs, and to tell no one whatsoever about our mission. He told us that the wing bombs were already loaded and checked for us, and not to bother them, and when we returned to report them as "duds". We went over to squadron operations and met our gunner, who did not report to group, and, as far as I know, did not know of our special mission. When we got out to the plane a guard was standing there from armament section. He told us the wing bombs were already checked, which we already knew. I checked the bombs in the bomb bay, 6 of them, and they were 6 regular 500-pound bombs. We took off at 0300 and flew to Hwangju, dropping our two germ bombs just outside the west edge of town. There were no explosions or any unusual things to be seen. Then we continued for two minutes to the north and dropped our eight live bomb

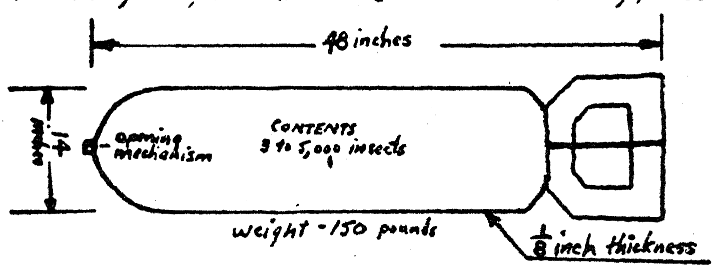
on the highway 5 miles north of Hwangju, and went directly back to Kunsan. We took off at 0300, our bombs were dropped at 0400, and we landed at Kunsan at 0500. This was the first time I ever heard of anyone dropping germ bombs, and we kept it a secret. These germ bombs looked exactly like a regular 500-pound bomb to me. In the day time they may have some distinguishing characteristics, but it was dark when I saw them. I did not load these bombs or see them loaded but there was no special equipment on the wings, so they are loaded in the same way as ordinary bombs.

When we reported to group intelligence for debriefing after this mission we reported two bombs (500 pounds) (as a matter of fact, 150 pounds) dropped at Hwangju and reported them as "duds", and reported where we dropped our eight good bombs. The bombs are evidently reported as "duds" to keep too many people from knowing the purpose of the mission, but higher headquarters can check the reports and know where the germs were dropped.

On the 10th of January, whether by accident or design I do not know, I was again scheduled for the same mission with Amos and Tracy. This time Amos and I reported to group operations, and we were told that all 4 of our wing bombs were to be germ bombs. This time our target was to be the town of Chunghwa, on Green 8, and we were then to get rid of the rest of our bombs as quickly as possible and return to base. We were still to keep our operation a secret and report our germ bombs as "duds". Our maximum airspeed was to be 200 miles per hour and our altitude 500 feet for the germ bombs. Once again armament was to have the wing bombs checked for us. We picked up Tracy at squadron operations and went out to the plane. Once again the wing bombs looked like regular bombs. An armament man told me that we were not to bother the wing bombs, as they were all set to go.

I checked the regular bombs in the bomb bay. At 0300 we took off and flew directly to Chunghwa, dropping our 4 germ bombs at 0410 hours, at an altitude of 500 feet and an airspeed of 190 miles per hour, on the western edge of Chunghwa. We proceeded south and dropped our regular bombs on the highway north of Hwangju and returned to Kunsan base, landing at 0515.

When we reported for debriefing we reported where we had dropped our 6 good bombs, and reported 4 "duds" at Chunghwa, for the same reason as before, for secrecy.



DRAWING OF GERM BOMB

Above is a drawing of the type of germ bombs which we used.

As I see it, the germ bombs come from a medical supply source, such as the same type which manufactures the vaccine used to combat disease, and I believe this source is in Japan, either on Honshu or Kyushu Island.

If the type of germ bomb which we dropped is used, it will open on contact with the ground, exposing the germs and insects to the open air. If it is cold outside, the insects will be dormant and sluggish, but the sun will cause them, by its heat to become active.

The leaflets are dropped in North Korea by B-29's. These leaflets are dropped in boxes which open in the air scattering the leaflets over a wide area. These leaflets can be used in bacteriological warfare.

When the germ bombs are dropped, they are released by the pilot. The navigator takes notes on when and where they are dropped, and how many germ bombs. The bombs are released by pushing a button, which releases the bombs by electricity.

After the mission when the crew reports to group intelligence for debriefing, the whole crew attends the debriefing, and the report is given by the pilot and navigator. It is an informal report, and the whole crew sits around a table and give their report to an enlisted man from the intelligence section, who takes the report and puts it on paper, which he turns in to his superior. This is why the germ bombs are reported as "duds," to keep unauthorized personnel in intelligence and on the crew from knowing the secret of the mission.

To the best of my knowledge, B-26 aircraft are the only ones dropping the regular germ bomb, which looks like a regular bomb. However, the B-26 is unsuitable for dropping the other types of weapons. The leaflets are dropped by B-29's and cargo type, C-47 and C-46 aircraft, but mainly by B-29's. The cargo type aircraft are the best suited for dropping all other types of germ weapons, such as cardboard boxes, parachute containers, and articles of clothing, food, soap, and paper and fountain pens, but the B-29 can be used for these weapons also.

As to when we first started to use germ bombs, it was about the first of the year, about 1 January, 1952, I should say, since that is when we were all reminded to look for "dud" bombs. It is probable that other outfits, such as the 452nd Wing, started to use germ warfare at the same time.

The decision to use germ bombs, of course, is top secret but due to the serious nature of this decision it undoubtedly rests with a very high command, probably the Far East headquarters in Tokyo.

Kenneth L. Enoch

Kenneth L. Enoch

7 April 1952.

APPENDIX LL

Testimony of Lt. J. Quinn Concerning His Participation in Bacterial Warfare Waged by the American Forces in Korea (SIA/15)

How I Was Forced To Take Part in the Inhume Bacteriological Warfare Launched By the U.S. Wall Street

I am John Quinn, a 1st/LT in the United States Air Force, (serial no. 17993A.) I am 29 years old I joined the Air Force when I was 26 in Febuary 16, of 1948. My home is in Pasadena, California. After I graduated from aviation Cadets in Febuary 25, 1949 I was assigned to the Air University They sent me through a six weeks course on how to teach called the Academic Instructors Course after I finished they assigned me to the Academic Instructors Division as a Staff member. my job was training aide officer, to teach people how to make good use of pictures, charts, movies and slides in their instruction. I was teaching there when I got my orders to the Far East Air Forces for further assignment to fly B-26s in Korea I was told to report first on ~~October~~ August 25 to Langley Air Force Base to learn to fly B-26s. I was there for 8 weeks. We were sent from there to

Camp Stoneman for processing. At Camp Stoneman I was innocculated for Typhoid fever, Typhus, Cholera, and Smallpox. We left the United States by airplane and arrived in Japan on 27 November 1952. We arrived at Haeneda Air Terminal and taken to Foschu, area B, to await being sent to Korea. We were there until the 29th of November and then sent by train to Ashia Air Base in Southern Japan. It was an overnight trip by train and we arrived on the 30th. The same day we were sent by C-47 to Kunsan Air Base in Korea. I was assigned to the 8th. Squadron, 3rd group, of the 3rd Bomb wing. The 3rd group is composed of 3 squadrons, 8th, 90th, and 13th and is the only group at Kunsan

On December 17, 1951 I reported to the 8th Squadron orderly room and saw my name on the bulletin board to attend a lecture the next day at 9 o clock The next day Larson, a navigator who was also on the list, and I went to the lecture The lecture was given in the ground School building in a large room. Filled the room would seat 30 people. There were 20 people in the room, all pilots and navigators In addition to Larson and myself were Roberts 2nd Lt Schwartz 1st Lt, Rogers 1st Lt, Watson 1st Lt Duffy-Capt Long-Capt, all navigators Howarth-Capt, Land-Capt, Schmidt 1st Lt, Beeson Capt., Robertson-Capt, McAllister 1st Lt all pilots Larson and I had been drinking coffee and arrived a few minutes late the others were already there. The Capt that was talking seemed very displeased that we were late and repeated for us that the lecture that

we were to receive was considered very important and highly secret. That we were to pay close attention to everything that was told us but not to discuss the lecture later - even among ourselves. He said the lecturer had come from Japan and was an expert in his field. Then he introduced the lecturer, a civilian, as Mr Ashfork. Mr Ashfork was a middle aged man, 40 years old, slender, 5 ft 10", and losing most of his hair.

He started his lecture by telling us that his lecture was on Biological warfare. He said that it was a terrible thing to contemplate but in this day of the atom bomb when science was making such rapid strides, that we must be prepared for any turn of events. He said that we never know what turn events might take in the

future and that we must be ready to defend ourselves, we must also know how to carry out Bacteriological warfare ourselves in case it proved necessary He said that he had spent many years studying germ warfare and that he would give us as much information as he thought we needed

He first told us that there were many many ways of spreading germ warfare. Germs ~~had been~~ could be spread anywhere at anytime, that the means were ready. He told us that germs by themselves could not be dropped because they would die in 60 seconds in direct sunlight That germs could, however, be carried by many different types of insects and rodents These insects and rodents have been bred for many of their generations under laboratory conditions

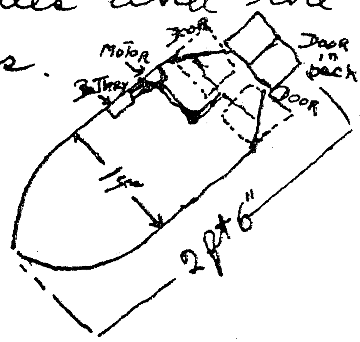
and selected for their ability to survive anywhere at anytime, even under the most adverse conditions. To name a few of the ways that they can be spread, he said, was by dust, just like a smoke screen is laid down. That they could be spread in this way by ships moving in close to shore when the wind was blowing onto shore. That they could also be spread in this way by low flying jet aircraft. He meant any type of jet aircraft. He said that they could be spread by bugs in clothes, fleas, flies, lice, and mosquitoes. These same bugs could also be dropped in many other ways, in boxes that would become very fragile in the sun and allow the bugs to crawl out, and also in bombs. He said since we were flying B-26s he would dicuss

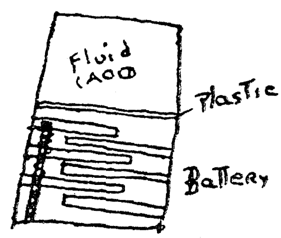
mostly this last way, by bombs. He then showed us pictures of a jet, a drawing of an F-84, spraying dust with germs, out of its tip tanks. He showed us a picture of some old clothes with bugs that looked like flies and lice crawling in them. These bugs can keep very warm in the clothes, altho he said that they can be selectively bred so that the cold wouldn't harm them. also they can go a very long time without food.

He then showed us pictures of bombs which could be used for dropping germs. These bombs looked very much like 500 pound G-ps that we had been carrying except that they had no fuzes. He said that the size and shape of the bomb was not important, only what it

contained. He said it was a very safe way to carry these germs since the bombs were sealed and would not open except when dropped from the airplane. The pictures he showed us was a picture of a 500 pound bomb with a very much thinner shell, less than 1/4 inch thick. These bombs, he said, were still in the experimental stage and there were various types. One picture he showed us was of a bomb that split in half when it struck the ground. Another had doors in the back (near the tail where the bomb curves) that open when the bomb hits. These doors are opened by a very small electric motor hooked to a battery which doesn't work until the bomb strikes the ground. The fluid is kept away from the

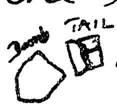
Plates of the battery until the bomb strikes the ground by a thin plastic shield. The force of the bomb hitting the ground is sufficient for the fluid to break the plastic shield and then the fluid covers the battery plates and the motor opens the doors.





also he showed us a picture of a bomb which the tail breaks off ~~of~~ when it hits the ground. All of these bombs that he showed us were made to ~~look~~ look like ordinary 500 pound bombs but none of them were pictured with fuzes; He told us they also had bombs which came apart in the air and the insects were scattered

In boxes to get them over a large territory before they struck the ground. He told us that these boxes would become very weak in the sunlight and the insects (flies, fleas, and mosquitoes) could crawl out. The structure of all three of the bombs he showed us was the same and they all looked like 500 pound bombs with thin casings. The first was shown split open 

the second with the doors in the back near the tail, and the third with the tail broken off 

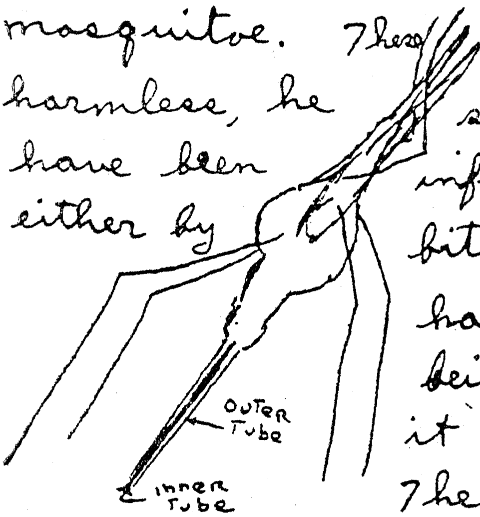
. ~~He said if it were ever necessary~~ The bombs that open in the air are hooked up by a regular arming wire to the wing bomb racks. They have a little propeller in the nose which cannot turn before the bomb is dropped because of the arming wire when

the bomb is dropped the arming wire stops with the airplane and the propeller is free to turn. The propeller turns a generator which supplies electricity to a small electric motor, just as the one I described. This motor first opens 3 doors in the back, just as in the other bomb, and then opens one door in the front. The wind thru the bomb is sufficient to blow the boxes out and they scatter as they fall. He showed us no pictures of this type of bomb and described it very little.

Next he described how germs could be spread. He said that almost any insect could be used for spreading germs, but he would just tell us about a few of them

In case any of these germs got back into South Korea
and that would be sufficient for our own protection. He said that Boubonic Plague could be carried by rats, but it wasn't necessary for the rats themselves to be dropped, altho they could be. The germs could be dropped in anything that rats could and would get into and they would pick up the germs and carry them. The insects can most easily be dropped and these carry many germs. ~~They~~ Flies can caray Typhus and Cholera and ~~so can~~ fleas can carry plague. Mosquitoes can carry fever of different types, yellow fever, typhoid fever, malaria, and encyphilitis for which no positive cure is known. Encyphylitis is also known as Japanese B and was brought to Korea first by Japanese as a desease in their own ranks. Very little is know about combating it and prevention

is the same as that for malaria. He said he would describe how malaria was carried and that the rest of the fevers were carried by mosquitoes in a similar way. He showed us a large picture of a mosquitoe. These mosquitoes are harmless, he said, until they have been infected with malaria either by biting someone who has malaria or by being infected with it in the laboratory.



The inner and outer tubes are both stuck into a person when bitten by the mosquitoe. The mosquitoe sucks blood up thru the inner tube and injects a form of saliva into the person thru the outer tube at the same time. If the mosquitoe is infected the germ is

carried by this saliva into the person bitten and he will get the fever. He said that the posters on the walls of the mess hall (on protecting yourself against encyphylitis) were not up there just to cover the walls.

He said that we must all follow rules of cleanliness, especially in the months to come. When we were given atabrin to take not to throw it away but to take it. He said we should all keep our innoculations up to date. If we did these things we had nothing to fear. The lecture started at 9 o'clock and was over just before 11. We all noted that germ bombs would not explode, that they would be duds.

In our regular briefing on the 31st of December the operations officer, told us to be sure and report all duds to the intellegence section at de-briefing when we returned.

On the 3rd of January I reported to group Operations at 2 o'clock in the afternoon along with 26 other pilots, 27 navigators, 27 radio bombadiers, and 27 engineers (in some cases these engineers were gunners. In our squadron we had 3 ships which could carry gunners). My crew was Rogers 1st Lt navigator, and Sayer Sgt. as engineer. We didn't carry a radio bombadier because the weather was good. I copied off the board our route assignment, which was Sariwon. to Pyongyang and our time of take off which was 2:30 in the morning. The regular briefing started

The regular briefing consists of the operations officer telling us that everything we are to hear is secret and to be treated as such - not to be discussed except among ourselves. Then the intellegence officer, ~~given~~ gave a picture of what traffic was sighted the night before and how many were damaged and destroyed. The army liason officer explained the front line situation and the weather officer described the weather to us. Other information, winds and temperatures the navigator ~~takes~~ copied off the board. In every respect this seemed like it was to be a regular mission

Rogers, Sayer, and myself met in group operations at 5 minutes after 1 and I went into the little room where the alert operations officer stayed at night, Capt Reynolds was on duty.

I gave him our names and he told me that I had a special mission. He said that before I did anything else I was to drop my wing bombs as close to Pyongyang as I dared get. He indicated a place on the wall map that he stuck a red pin into which was 5 miles south of Pyongyang and 3 miles east of the main highway. He said that we should then continue with our regular mission and finish it as soon as possible and report back to the intelligence section. He said that I should drop the bombs from 200 ft or lower if possible and for me not to worry about them exploding that they would be duds. I asked him what it was all about.

remembering the lectures we'd been given on germ bombs, but he said he didn't know and it would be best just to do as instructed and not worry about why or what. I thought it was germ bombs.

When we went out to the airplane we were met by a guard and then I was sure they were germ bombs. He said not to worry about the wing bombs, they'd already been taken care of. But I looked up at them when I was inspecting the airplane and noted that what the navigator said "the wing bombs don't have any fuzes" was correct. We both looked at each other and I said orders are orders and

we left it at that, I told him where we were to drop them and he marked it on his map

We took off at 2:25 and arrived just south of Pyongyang at 3:30. I turned east from the road, just south of the bridge, and when we reached 200 ft Rogers said this ought to be it and I dropped the four wing bombs, one at a time, in rapid succession. They were duds we both knew then for sure they were germ bombs

We finished the rest of the mission by 4:15 and landed back at Kunsan at 5:10. We left the airplane and after turning in our equipment and reporting that the plane was OK we went directly to the intellegence section in group operations for de-briefing. We reported that we had dropped

four bombs where we had been told at 200 ft and that they were all duds. The sgt took this down to give to intellegence that ~~next~~ morning.

On January 10th I was briefed on a regular mission as usual to fly between Kunuri and Kangye at 2 o'clock in the afternoon. My crew was Schwartz 1st Lt navigator and Sayer Sgt. engineer. Our take off time was 2 o'clock the next morning. This briefing was routine. When we reported at 12:30 to operations I went in as usual to check off. our names and was told again that I had a special mission Capt. Reynolds was again on duty. He remembered that I had already. had one special mission with duds so he referred to that and told me this would be the same type of

of mission. That this time I only had two duds and that I should drop them North-east of Kunuri and he showed me the place on the wall map which was 3 miles North of Kunuri and 5 miles east of the railroad track. Again we were met by a guard at the airplane and told that the wing bombs had been taken care of. I noticed that again the two outboard bombs had no fuzes. I told Schwartz where we were to make the special drop and we knew we had germ bombs. We took off at 2 o'clock and arrived over Kunuri at 3:25. I turned when Schwartz told me to and let down to 200 ft. and dropped the bombs. They were duds

we finished up the rest of the mission as quickly as possible and started back to Kunsan, at 4:10. We landed back at Kunsan at 5:25 and after turning in our equipment and telling them the airplane was OK we went to the intellegence section in operations and reported having dropped two duds and where we dropped them. The Sgt made a note of this to give to the intelligence.

— On the 14th of December I noticed my name on the bulletin board to attend a lecture the next morning at 9 o'clock in the ground school building. I was there at 9 o'clock in the large room with 25 other Officers, pilots and navigators. Beeson, Capt. Schmidt 1st/Lt, Long Capt, Sand Capt, Howarth Larson 1st/Lt Capt. Schwartz 1st/Lt, Roberts 2nd/Lt, Watson 1st/Lt

were there. Maj Allen, base operations officer was the senior officer present and introduced the lecturer. He said that this lecture was important and secret. He said that the lecturer, Mr Clark was an emminent physicist in the field of nuclear research and that he was there to explain some about atomic warfare to us. He said Mr Clark had come from Japan.

The lecturer started by saying that the science of atomic warfare had advanced a long ways since the bombs that were dropped on Hiroshima and Nagasaki. The days when these bombs could only be carried by B-29s was over. Bombs of that size were now many times (he didn't say how many) as powerful as they were then. That bombs could now

be made almost any size they wished to make them. He said that they had conducted experiments in the United States on what he called the "baby" atom bomb and that they were doing further work so that they could be used as artillery as well as bombs. He said that work on a mortar shell with an atomic warhead was nearly perfected for use. He said that much progress was being made on the hydrogen bomb which would be a thousand times more powerful than the types of atom bombs we now had. He said that these bombs, a single one, could completely level a city like New York. Then he told us that there were various ways of using atom bombs. They could be dropped to explode under ground and

spread radio active dust over a large area. This dust is deadly to any living thing it comes in contact with and the radio activity lingers many weeks. He said that the bombs could be dropped by parachute to explode in the air as they were at Hiroshima and Nagasaki and in this way the heat and blast effect is more deadly, that the radio activity is not so persistent and most of it blows away and disperses in the air He said that the bombs could be exploded deep under water and this could be used on cities near the coast That it would lift most of the water out of any known port, the deeper the better, and the water would be radio active and rain down on the city. Besides that there would still be the

blast effect and a tidal wave would rush in to fill up the harbour and do much damage. He said that experimentation had been done on radio active clouds which would hold radio activity for a long time and would be deadly wherever it rained.

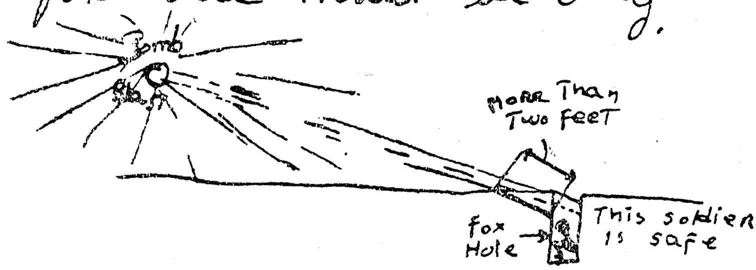
He said that experiments on the smaller atom weapons (bombs) had been carried out in ~~in the~~ Nevada, United States, with troops in the fields near the blast - about 2 miles away, and that no one had been hurt. This was because the explosions had been small and proper precautions had been taken. He said that they had all been clothed well and were in deep fox holes so that their head were 2 to 3 ft below the top of

the fox hole. This was a very necessary precaution, he said, and we should understand why.

The atom bomb gives off three rays, he said. when a bomb goes off theas is first very much heat created, the center of the blast is many millions of degrees, as hot as the sun, and this heat wave extends outward from a half mile to many miles depending on the size of the blast next there is the shock wave which is much longer in duration than a high explosive blast. and next there is the radio activity. If you are far enough away from the blast not to be killed outright the fox hole will protect you against both the heat wave and the blast effect, and also

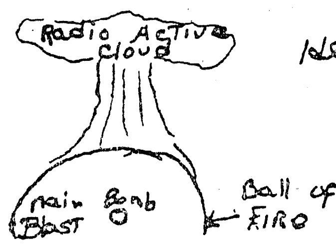
against radio activity unless it comes in as dust or rain. The three rays given off by the atom bomb are alpha, beta, and gama. The alpha and beta only last during the eplosion and if you are safe from the searing heat of the blast, then even a shirt, especially a light coloured shirt, is sufficient to keep the alpha and beta rays from burning you where ever you don't have clothes like hands, neck, face, that part will be burned that is facing the blast when the bomb goes off The gama rays last for a longer time depending on the type of blast, but a fox hole is good protection against this altho clothes are not of any use. Only

lead or a thick layer of dirt will stop these gama rays which go thru everything just like x-rays and destroy the life of bones and cause blood to break down. Then he showed us pictures of how the fox holes must be dug.



He said that a half inch of lead would stop the gama rays, but it took at least two feet of dirt to stop them. They could penetrate almost two feet of dirt. The area around the blast continues to give off gamma rays because those objects which are strongly effected by the gama rays also become radio-active and give off these rays. It would be very dangerous to touch

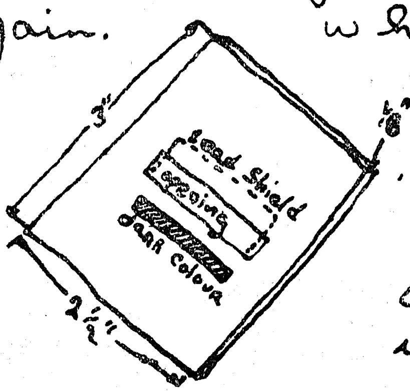
especially metal objects which were in the near vicinity of the blast. He said that most of the radio active gamma rays are carried off in a large cloud in an air burst and dispersed by the winds He showed us a picture of this.



He said that although after being dispersed they would not be harmful to people, that a report had come from a photographic laboratory in New York, several days after the experiments in Nevada, that much of their photographic paper showed signs of having been exposed to gamma rays These rays had traveled in clouds all the way across the United States and exposed this

paper. He said that because of most of these rays being carried off in the radio active cloud it was quite possible to safely enter an area after an air burst provided you didn't stay too long. However, except when absolutely necessary to enter for some reason it was best to wait until trained people could go in first with giegar counters. If you must go in, he said, don't touch metal objects. He said that they had a pocket radiation detector that could be carried by everyone that would indicate when you had been in the area as long as was safe. He showed us this object which was the same size as a pack of cigarettes but only 1/4" thick. It had an opening

in the middle 1/4" high and 2" long covered with a thin piece of lead This lead could be slid out of the way and expose the opening Behind the lead was a piece of Photographic paper which would turn dark when exposed to radio-activity. It also had on the outside a colour with which to match the coulor of the paper so that when they matched you could leave the area, otherwise you would get too much radio-activity and it would be dangerous. After you go in once you can't go back again.



when you enter the area you raise the lead shield and then watch the colour of the opening and compare it to the dark colour and leave when theyre the same

Next he told us that these pocket indicators were only necessary substitutes for giegar counter which were much more accurate. The giegar counter works like a radio and when it is near radio-activity you can hear it in ear phones connected to the giegar counter. also it has a little meter which looks like an amp meter in a car to tell how much radio activity is present. He said it was measured in radiotrons, or some term like that. Then he let each of us file up and put the earphones on and listen as he brought a piece of radioactive material near the giegar counter. at first the ticking was very slow but as the piece came close the ticking got very fast until it sounded like a purr, one tick mixed with the next.

The lecture lasted from 9 o'clock to 10:30.

It is very clear from these facts that the capitalistic wall street war monger in their greed, their ruthless greed, have caused this horrible crime of Bacteriological warfare to be launched in order to get more money for themselves and in the hope of spreading this war. Even their desire to start a third world war by adding atomic warfare to their list of inhumane crimes is indicated. These imperialists will stop at nothing to get more money in their pockets and the more war the more they make. They do not care about the innocent people of the world. Surley the people of America, the workers, if they know about these crimes must condem them. The american

workers seldom get the truth from their newspapers, magazines, and radios which are controled by the money mad wall street imperialists These war mongers do not want the people to learn the truth or they would not permit them to carry out their war mongering inhumane crimes against the people of the warld. It is very clear that they are doing these inhumane crimes to expand the war and make more Profits.

I was forced to be the tool of these war mongers and made to drop germ bombs and do this awful crime against the people of Korea and the Chinese Volunteers. 1, cause I am a soldier I must follow orders and these orders came from those imperialists on wall Street. I could not refuse to

do this crime But on the other hand I was the person who did this inhumane crime against the people, by carrying germ bombs and dropping them where innocent women and children would be the most likely victims. This is a horrible crime against the people, even the German Nazis would not use it those people like Ilsa Koch who would make lamp shades out of human skin would not use it, but I used it for the U.S. imperialist warmongers of wall street. Since I have been captured by the Chinese volunteers and I laid down my arms I have been treated far better than a person who had committed even much lesser crimes deserves to expect But

they always said after I laid down my arms that I was no longer an enemy. They explained the lenient policy toward POWs which I, braught up as I was on the propaganda lies of the Wall Street imperialists, found very difficult to understand But the Chinese Volunteers were very patient. They issued me warm clothing against the cold, gave me excellent food, bedding, and a warm place to sleep. I am eternally grateful for their kind treatment. at last, after much patience on the part of the volunteers [redacted] I realized my crime. My own concience bothered me a great deal, and it is very good to be rid of this burden, to confess and repent.

I have realized my terrible crime against the people, I have done an inhume thing against innocent peace loving people. I know now how wrong this crime is, and I ask that the people can see it in their hearts to forgive me for this crime. It was a crime against all the peace loving people of the world ~~and~~ one which should surely be condemed by all peace loving people. I ask forgiveness from all people who want peace because my crime has been against them.

John Quinn
13 April 1952

APPENDIX MM

Testimony of Lt. F. B. O'Neal Concerning His Participation in Bacterial Warfare Waged by the American Forces in Korea (ISCK/4)

My Testimony

How I Was Ordered to Participate in the Germ Warfare Waged by the American Forces in Korea

I am Floyd Breland O'Neal, a second lieutenant in the United States Air Force Reserve, AO-1848575. I am 24 years old and my home address is Box 66, Moye Avenue, Fairfax, South Carolina. I have not married yet and have only my mother, one sister, and four brothers. I attended The Citadel college at Charleston, South Carolina, from September 1945 to June 1948, receiving a B. S. degree and a commission as a second lieutenant through the Reserve Officers Training Corps. In September 1948 I attended Tulane University in New Orleans, Louisiana, where I held a position as a graduate assistant in chemistry, which was to supervise the freshmen in their chemical laboratory work and to grade papers for the freshmen, and worked on my Master's degree at the same time. I graduated from Tulane in June 1950, receiving an M. S. degree in physical chemistry.

I was then recalled into the service and chose flying training in August 1950. I reported to Randolph Air Force Base at San Antonio, Texas on August 24, 1950, and received my basic pilot training there until March 19, 1951. I received advanced pilot training at Craig AFB at Selma, Alabama in F-51s from April 3, 1951 to September 15, 1951. I was then assigned from Craig to the gunnery school at Luke AFB at Phoenix, Arizona. On December 1, 1951, I re-

ceived a secret lecture on bacteriological warfare at this school. I finished my gunnery training on December 15, 1951 and reported to Camp Stoneman, California on January 3, 1952, and waited for overseas shipment there. I received tetanus, typhoid, cholera and smallpox shots at Camp Stoneman before I left the States.

I left Camp Stoneman on January 10, 1952 and arrived at Haneda AFB at Tokyo Japan on January 12, 1952. I was taken to Foochow Area B for further assignment and on January 16, 1952 I left Japan from Tachikawa A.F.B. for K-10 at Chinhae, Korea which is the rear base for the 18th Fighter Bomber Group. At K-10 I was assigned to the 67th Fighter Bomber Squadron, 18th Fighter Bomber Group. On January 19, 1952 I was sent to K-46, the advance base of the 18th Fighter Bomber Group which is located about 5 miles north of Wonju, to be checked out in combat operations. I was assigned to Item Flight in the 67th Squadron and received lectures on group and squadron policies such as the types of formations used, the discipline expected, and the rest leave policy. I received two orientation flights at K-46, one a solo flight to familiarize myself with the area, and the second a formation flight carrying a full load of armament, which was dropped in the ocean off the east coast of Korea. I was then called "combat ready".

I received a lecture on bacteriological warfare on January 22, 1952 at K-46. My flight, Item flight, was on rest leave at the time in Japan and I had to wait for their return before I began flying missions. I flew my first mission on January 28, 1952. We were flying F-51 aircraft or Mustangs. I flew my

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first and only germ warfare mission on February 15, 1952. I was ill with pneumonia from February 20, 1952 to February 29, 1952, being sent to the hospital at K-10 on February 22nd. I began flying missions again on March 3rd. On March 4th I was shot down by antiaircraft fire on my 13th mission west of Sinmak at approximately 09:15. I was captured immediately by members of the Chinese People's Volunteers.

I Attended a Secret Lecture on Bacteriological Warfare at Luke Air Force Base.

The secret lecture at Luke AFB on bacteriological warfare was given on December 1, 1951 in the base theater to all of the gunnery school students. There were about 70 students present, 40 from the F-84 squadron and 30 from the F-51 squadron. The lecture was held at 15:00 hours and lasted for approximately half an hour or until 15:30 hours. Among those gunnery students present beside myself, so far as I can remember, were Captain William Pohner, 1st Lt. Joe Young, 1st Lt. Frank Charette, 1st Lt. Allen Bettis, 1st Lt. John Yingling, 1st Lt. W. C. Sankey, 2nd Lt. Mel Souza, 1st Lt. R. L. Michael, 1st Lt. R. S. Greyell, 1st Lt. Jack Cook, 1st Lt. John Shelander, 1st Lt. Rick Canady and 1st Lt. Jack Shepard. All of the officers were assigned to the Far East at that time, and of them 1st Ls Yingling, Sankey, Souza, Greyell, Michael and Shepard are already in Korea, all assigned to the 67th Fighter Bomber Squadron, 18th Fighter Bomber Group.

The lecture was given by Major Kethel W. Williams, an Air Force major. He was introduced before his talk by the base information and education officer, a captain whose name I do not remember now. The

captain said that the major came to Luke from Washington especially to give this lecture about once a month to the new gunnery students assigned to Luke who had not received the lecture previously. Major Williams was assigned to Headquarters, USAF. I imagine he was under the Deputy Chief of Staff for Operations. The major was about 5 ft 8 in tall, looked to be around 34 years old, and had a deep voice. He was of average build and had a slightly protruding stomach.

The major began his talk by telling us that the topic and contents of his lecture were classified as secret information and that what he said was to go no farther than the four walls of the theater. He stated that the purpose of his giving this lecture was to introduce the subject of bacteriological warfare to us and to give us general knowledge so that we would have a foundation in the subject and it would not be new to us if it were ever brought up again. He then began his lecture.

He said that bacteriological warfare could be waged in two ways (1) by the ground forces using bacteriological artillery shells, and (2) by the Air Force dropping germ bombs, these germ bombs containing either bacteria or bacteria-infected insects. He said that the Air Force could deliver more bacteria in one germ bomb than the ground forces could deliver in many germ shells; also that the range of the artillery was limited to the front lines or relatively close to them while the Air Force could deliver their germ bombs far behind the front lines and deep into enemy territory. Thus the artillery germ shells would be directed against enemy front line troops while the germ bombs would be used against reserve troop concentrations behind the front lines

and against enemy towns and cities.

The major said that the danger to artillerymen and crews of the aircraft carrying the germ shells and germ bombs was very small - none, in fact, unless there was an accident, such as accidentally dropping the germ shells and germ bombs and the bacteria or bacteria-infected insects were allowed to escape and contaminate the area. He said that these germ shells and germ bombs were prepared and handled by special crews who had been trained for this type of work. He said that an anti-toxin had been developed for each type of bacteria so that our men were safe from the danger of catching any of the diseases used in this type of warfare.

The major told us that bacteria are grown in our special laboratories in culture mediums, each type of bacteria requiring a certain culture medium and special conditions of temperature and humidity for growth. He told us that the insects and rodents used for bacteriological warfare were chosen from among those known to medical science to be carriers of diseases, such as flies, fleas, lice, ticks, gnats, mosquitoes, spiders and rats. The insects and rodents are also grown in our special laboratories at Aberdeen, Maryland.

Major Williams said that special cold-withstanding bacteria and insects had been developed for use in bacteriological warfare in cold climates. The bacteria are made to withstand cold by acclimatization. The bacteria are placed in air baths and the temperature and humidity lowered small amounts at a time, allowing the bacteria to become used to the change before lowering the temperature and humidity again. In this manner, the bacteria would become used to

colder and colder climates. After each change only the strongest bacteria are used for the next lowering of the temperature and humidity.

The cold-withstanding insects are obtained by cross-breeding. One insect which is a disease carrier will be cross-bred with a similar insect which is used to a cold climate, The offspring is then crossbred with an insect used to the cold climate, and by continuing this cross-breeding an insect can be obtained which will have the desired disease carrying characteristics as well as being used to a cold climate.

The major said that such research on bacteria and insects done on this project was extensive, and also expensive, but that this research had given the United States forces the desired bacteriological weapons. He told us that most of this research was being done by the Chemical Corps and the Army Ordnance Department in the so-called "Special Projects". The Army Ordnance Department has large laboratories at the Aberdeen Proving Ground in Maryland. Most of the work done at Aberdeen is done by men in the Army who are specialists in the various fields. Scientific workers in the Civil Service also work here and leading scientists of the nation are available for consultation. The Army Ordnance Department will design the germ bombs in cooperation with the Air Force, the Air Force supplying the qualifications and specifications and the Army doing the actual designing and construction work on the germ bombs.

The major told us the common types of bacteria used for bacteriological warfare such as

typhoid fever, typhus fever, cholera, bubonic plague, malaria fever dysentary, yellow fever, etc. These diseases are not necessarily fatal, but all are serious illness-causing bacteria. The persons catching these will become very ill and unless prompt medical care is obtained, many will die. If an epedimic could be started among the troops or the civilian population, much damage would be done. Those troops affected would be useless as far as battle is concerned and the civilian population affected would be able to do no work. The medical facilities of the enemy would be heavily burdened and conditions in general would be bad. The major pointed out that morale would be especially low and that this would also help weaken the enemy forces, both on the front lines and in the rear areas.

The major had a few notes before him which he would briefly refer to on occasion, apparently an outline, so that he would cover his subject thoroughly and in the same manner each time. He said that he was going from Luke to Nellis AFB at Las Vegas, Nevada, to give the lecture at the gunnery school there. He again reminded us of the secret nature of the lecture and then he dismissed us at 15:30 hours. On the way to ground school at Luke we were wondering why we had received such a lecture. We all felt surprised at the nature of the lecture.

Captain McLaughlin's Lecture on Germ Warfare

The lecture on bacteriological warfare at K-46 was given by Captain McLaughlin on January 22, 1952 in the small debriefing room behind group operations. The other pilots present besides myself were 2/Lt. Pete Kibley, 2/Lt. Jim Horsley, and 2/Lt. R. S. Greyall. We were returning to

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our tent when we were told that Capt. McLaughlin was looking for us. The four of us went into the group operations building and Capt McLaughlin took us into a small debriefing room in the rear of the building. This was at 14:00 hours. Capt. McLaughlin is the group intelligence officer. I don't know his initials, but we usually called him "Captain Mac". He is about 5 ft 10 in tall, around 30 years old, and has black hair which is beginning to turn gray.

The lecture had been given previously to all of the pilots in the group and we received it then because we were new arrivals. The room was about 8 by 10 ft in size, with a table and chairs and a blackboard on the wall at one end of the room. We were told to make ourselves comfortable and to smoke if we wished. The Captain then told us that even though our regular missions were classified "secret", we could discuss them among ourselves and tell each other what we had done. However, we were not to mention the subject he was about to bring up to anyone at all, and we must not discuss the subject even among ourselves. He told us that it was "top secret" and stressed the fact that we should never discuss it with anyone. He said that what he was about to tell us was a new subject to us and that we should pay close attention to what he was saying. He then began the lecture dealing with germ warfare.

The captain did not have any notes with him and did not refer to any during the lecture. It was apparent that he was thoroughly familiar with the subject and had received training in it. I imagine that he received his training at Aberdeen, Maryland. The intelligence school in Washington, D.C. is fairly close

to Aberdeen. I did not ever hear the background of Captain McLaughlin discussed, so I cannot state positively where he received his training.

He said that there were two general types of germ bombs: (1) air burst type and (2) parachute type. The parachute type were used for dropping insects infected with bacteria and the air burst type were used for dropping bacteria. It is also possible to spray germs and insects from aircraft, as well as to drop various infected articles such as leaflet, papers, etc. Our group was using the air-burst type of germ bombs and spraying at that time

The air-burst germ bombs, Capt. McLaughlin said, are the same size as a regular 500 lb. bomb, only they weigh about 150 to 200 lbs. These bombs are especially made for this purpose. They contain jelly-like materials in which the bacteria are living. The bomb will contain enough explosive powder to scatter the jelly but not too much, as too much would kill the bacteria. The bomb would have a regular air-burst or variable time, "VT", fuse which would explode the bomb about 50 to 100 ft above the ground. The bombs have to be dropped at least 5000 ft. above the ground as this distance is necessary for the VT fuse to properly arm itself so that it will explode at the proper height

The captain said that the types of bacteria which could be in these germ bombs were typhus, typhoid, cholera, dysentary, and bubonic plague. Insects are not used in these air-burst bombs because of the danger of the insects being killed by the explosion. The VT fuse is set up so that if it does not have time to properly arm itself and explode in the air, it will ex-

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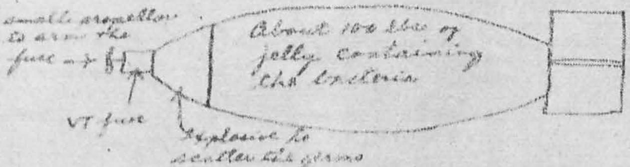
plode upon contact with the ground. These germ bombs have a lighter casing or outer shell than the regular bombs, that is, the outside is thinner, so that they can easily burst when the explosive charge is set off. The germ bombs



weight : 200 lbs
length : 3 ft
width : 1½ ft
outside casing is 1/8 of an inch thick

Air Burst Type of Germ Bomb

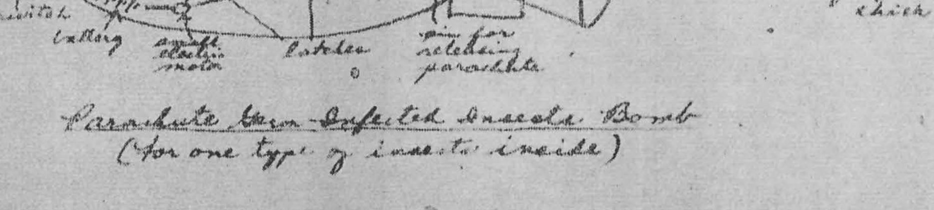
are brought in and are handled by a special crew from the armament section, at K-46 the germ bombs are kept in a concrete underground shelter in a barbed wire enclosure in the bomb dump next to the loading area. The germ bombs are placed on the planes by the special crew from the armament section.

The captain told us that in the event of engine trouble on the way to the target, if we were south of the bomb line or in friendly territory, we should drop the germ bombs in an uninhabited area. We were to circle the place where we dropped the bombs and call a radar station for a "fix" on the exact location of the place where the bombs were dropped. The radar stations can give us the exact location and we were to report this position immediately to group operations so that men could be sent to this spot to remove the bombs so that our forces will not be exposed to danger. We were to drop the bombs unarmed. (Normally, a bomb is armed by the pilot, who will push two electrical switches in the cockpit if he wishes the bombs to explode.) If we were north of the bomb line or in enemy territory, we were to

drop the germ bombs armed and report the location where they were dropped if it was different from the assigned target area.

The captain said that we should do our best in aiming the germ bombs so that none would be wasted and so that the targets would be hit correctly. He said that the germ bombs were expensive and hence the necessity for wasting as few as possible. We would be using the germ bombs over towns or over areas which had large troop concentrations in them, as the bombs would be most effective if dropped very close to human beings. The germs could thus contaminate food and water supplies as well as being scattered over the people and their clothes. The captain told us that we should not act suspiciously when we went out to our aircraft to fly a mission with germ bombs, but to act normally, as if nothing unusual were happening.

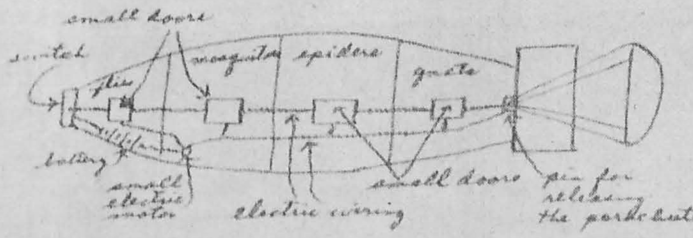
Captain McLaughlin then briefly explained the parachute germ bombs and how they worked. These parachute type germ bombs were used for dropping bacteria-infected insects rather than germs. The bomb would have some sort of device to release the insects when the bomb touches the ground. The parachute germ bombs had no fuses and no explosive powder. The method of releasing the bacteria-infected insects, when only one type of insect



Parachute Germ-Infected Insects Bomb
(For one type of insects inside)

was used in the bomb, was for the bomb to split into two sections when it touched the ground. The parachute would be released at the same time so that it would not cover the insects and trap them under it. When the germ bomb touched the ground the switch in the nose would start the small electric motor, which would unfasten the latches and allow the two sections of the bomb to fall apart. The motor would also pull the pin out of the parachute harness, allowing the parachute to be blown away by the wind.

If the germ-infected insect bombs contained more than one type of insects, they could be separated by pasteboard partitions inside the bomb. Then when the bomb touched the ground there would be a small door in each section which would open to release the insects.



weight: about 20 lbs
length: 3 ft
width: 1½ ft.
outer casing: ¼ in. thick

Parachute Germ-Infected Insect Bomb
(Door type with four sections)

When the bomb touched the ground the switch would start the motor, which would open the doors to release the insects, and at the same time release the parachute pin, allowing the parachute to fall free. At this point we were given a ten minute rest to get a coke.

The Captain then explained the set-up used for spraying germs or insects. The apparatus for spraying was mounted in the rear end of the aircraft. The fuselage gasoline tank which is normally behind the pilot

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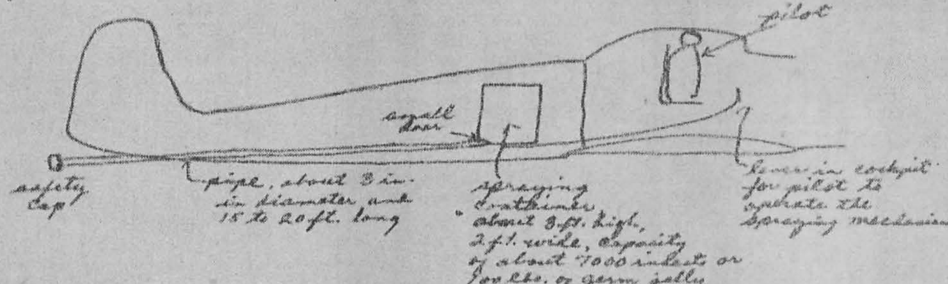
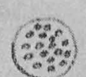
would have to be removed in order to insert the container which was to hold the germs or the germ-infected insects. This would be a special aircraft which would be used only for spraying purposes. A special crew would handle the cans of germs or insects to get them into the container of the spraying aircraft.



Spraying Mechanism in the Special Aircraft

To start spraying, the captain continued, the pilot pushes the lever in the cockpit. This lever will open the can of insects or germs, open the door to the spraying pipe and push up the safety cap to allow the insects or germs to be sprayed out the rear end of the pipe. The spray nozzle on the end of the pipe, under the safety cap, would be removed for spraying insects as the insects could not escape through the small holes in the nozzle.

 ← spray nozzle, at the end of the spraying pipe, with small holes to spray germs out.

The germs would come in tin cans while the insects would come in cans with tin sides and screen or cloth ends so that the insects could breathe. The safety cap on the end of the pipe is closed by the lever in the cockpit so that no germs or insects

remaining in the pipe can escape after the aircraft lands. After landing the pilot would taxi to a special area for the aircraft to be sterilized by a special crew. The pilot himself would go in and change clothes and bathe himself immediately. His clothes would be sterilized. When an aircraft which had been on a spraying mission landed, there would be a truck equipped with a sprayer to follow the plane and spray the ground behind the aircraft with a disinfectant to safeguard the base.

The captain went on to say that the jelly with germs would be diluted with water or some other solvent, as the jelly itself could not be sprayed for it is too thick. The aircraft used for spraying the germs or germ-infected insects would be restricted to fighter type aircraft as they are the most maneuverable at low altitudes. The altitude used for spraying would be 500 to 1000 ft above the ground. The airspeed used for spraying germs or germ-infected insects would be 350 miles per hour for the former and 200 miles per hour for the latter. F-51s, F-80s, F-84s, or F-86s could be used for germ or bacteria-infected insect spraying missions. In the event of engine trouble, the pilot was to land at the closest friendly airfield. If the engine quit anywhere, the pilot was to bail out and let the aircraft crash and burn, as the fire would destroy the insects or germs. This type of mission would usually be flown by two aircraft, flying side by side, separated by about 200 yards. The missions of spraying germs or infected insects would be flown over towns or troop areas.

The captain told us that our group had four air-

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craft equipped for spraying germs or infected insects. These aircraft are parked at the north end of the parking ramp away from the rest of the aircraft. Each aircraft has a mechanic and also one of the special ground crew trained for germ warfare to take care of the spraying apparatus. Besides these four men, there are other special crew members attached to the armament section to handle and load the germ bombs and germ containers.

The aircraft to be loaded with germ bombs are parked next to the special ramp for loading. The germ bombs are loaded at night or early in the morning by the special crew. The spraying aircraft are taxied down to this area to have the germ containers loaded into the spraying mechanism. There are a chain hoist to help load the germ containers into the spraying aircraft and the usual bomb-loaders to assist in loading the germ bombs onto the aircraft.

The captain said that the germ bombs and containers came in from Japan by air about every two weeks and a large supply was not kept on hand but they were brought in as needed. The germ bombs are brought in from Japan in cargo aircraft such as C-46s, C-47s and C-54s.

The air-burst germ bombs could be dropped by B-26, B-29, F-51, F-80, F-84 or F-86. The B-26 and B-29 are most suitable for dropping parachute germ bombs.

The captain touched briefly on the growth of bacteria. He said that they are troublesome to grow and required constant care. They require special condition for growth, being grown in culture mediums, and they were expensive to cultivate.

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The captain again warned us that this was top secret information and that we were not to repeat any of it or even discuss it among ourselves. He was very grave and stern-looking as he said this, and we realized the seriousness of the situation.

The lecture had lasted for two hours, from 14:00 to 16:00 hrs, with a 10 minute rest at 15:00 hours. It was given in the small debriefing room because of its secret nature. This room was so small that only small groups of us received the lecture together. The briefing room is large enough to accomodate 60 people, but there are people in and out of the briefing room all of the time and secrecy would have been impossible. There were only ten of us who were new to the group and so the briefing room would have been large enough for all of us, while the debriefing room limited the size of the group of us. Captain McLaughlin explained his talk by drawing about 7 diagrams of the bombs and spraying mechanism on the small blackboard with chalk and pointing to each part of the diagram as he discussed it. He had evidently given the lecture enough times so that he was so familiar with the subject that he needed no notes, even for reference. He had undoubtedly given the same lecture to each new pilot who had come into the group.

After the lecture was over, we left the room and returned to our tent, no one saying anything. Each of us was thinking about what we had just been told. I was wondering why we were using this terrible weapon when the peace talks were going on and the war was at a stalemate. We sat down in the tent and looked at each other for a few minutes. Then I suggested

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a card game of hearts to shift our thoughts to more pleasant topics than the one we had just heard.

My Participation in the Germ Bombing Mission

Stem flight was assigned the first mission of the day from the 61st Squadron on February 15, 1952. 1st. Frank Harvey, the flight leader, chose 1st. Padgett, 1st. R. S. Greyell and myself to accompany him on the mission. We went to early or 05:30 briefing. Nothing was said in the regular briefing about germ warfare. All of the squadrons were represented by about 20 pilots at this briefing. Some were going on rail cuts, some on the Main Supply Route cap, etc. The operations officer, Major Clark, asked who was going on the first mission from Topkick, which is the call sign of the 61st Squadron. When "Stem Flight" was called out, he said "Flak Suppressor". He then went on with the other missions, giving the assignment with any special instructions. We then all set our watches to the correct time. Next we received the weather briefing by 1st. Scott, and then the intelligence briefing from Captain McLaughlin.

Briefing was over at 05:45 and Capt. McLaughlin called out "Stem flight come up and get the photos". We went to the front of the room and the captain led the way to the small debriefing room where he had given us the lecture on germ warfare days before. He handed 1st. Harvey an aerial photo of Sibyon-ni and then said "You'll be carrying germ bombs. Drop them on the west side of town and come directly back to K-46. I'll be waiting to debrief you. Report the bombs as air-burst VT bombs when you debrief. Remember not to act strangely when you go out to the aircraft. Remember that this is

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top secret".

We went over to 61st Squadron operations and left the photo there while we went to breakfast. We didn't talk about the mission we were about to go on. After breakfast we went back to Squadron operations and planned the mission - the route up, altitudes, airspeeds, etc. Captain McLaughlin had told us that our take off time was at 08:00. The usual time was 07:00 for the first mission. We put on our parachutes and went out to the aircraft. Our four aircraft were parked right next to the loading platform. We inspected the aircraft to see that everything was in order. The germ bombs were already on the wings, having been placed there by the special crew from the armament section. I only checked the arming wire in the nose fuse of the germ bomb to make sure that it was in position properly and then got into the aircraft.

We took off and climbed on course, leveling off at 9000 ft at an airspeed of 250 miles per hour. We went to a point about 10 miles west of Sibyon-ni and then headed east toward the town. As we approached Sibyon-ni, 1st. Harvey gave the signal to get into in-trail formation, by diving and climbing the aircraft several times quickly - no radio signal, and then he began his dive-bombing run. We began our runs at 9000 ft, released the germ bombs at 7000 ft and pulled out of the dive at 6000 ft at an airspeed of 350 miles per hour. We then climbed up to 7000 ft and returned to K-46 at 250 miles per hour. We took off at 08:00, dropped our germ bombs at 08:50, and landed at K-46 at 09:30 hours. When we dropped our germ bombs, we armed them by pushing two electrical switches in the cockpit and we

dropped our germ bombs by pushing a button on the control column (or stick). Each of us had dropped two germ bombs on Sibyon-ni - eight germ bombs total. We did not know what type of germs the germ bombs we had dropped contained. We only knew that they were germ bombs.

After landing, we parked the aircraft on the ramp and went to Squadron operations to put up our parachutes and flying helmets. We then walked across the street to intelligence, where Capt. McLaughlin was waiting for us. He said "I'll get them", meaning that he would debrief us. After a normal mission any of the intelligence personnel can debrief the pilots. He led the way into the small debriefing room where we had received the photo and special instructions earlier. I had seen the germ bombs of the first three ships go off and the leader had seen mine explode, so we reported 8 bursts of VT bombs over the target. The debriefing form which the captain used looked like the regular form and the questions he asked were the usual ones, such as flak encountered, weather over the target, any malfunctions, any troubles, any enemy aircraft sighted, names of pilots, aircraft numbers, etc. The true nature of our mission was not mentioned. We reported a successful flak suppressor mission. We had gone into debriefing at 09:40 and finished at 09:45 hours.

I had flown aircraft number 055 that day, flying the number four position. Harvey was leader, Gregell was number two, and Padgett was number three. When the germ bombs had exploded, they were grayish clouds of smoke, or at least that is how they

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looked to us from above. The sound of the explosion to those on the ground would have been small, not nearly so loud as an ordinary bomb. The germ bombs were all dropped over the west side of the town of Sibyon-ni.

Our Group Activities in Germ Warfare Missions

Judging by their actions at our base, I am sure that every pilot in the 18th Group had carried out germ warfare missions. The relatively new pilots like myself had few of these missions, while the old pilots, or ones who had been in the group longest, had more. Lts. Harvey and Padgett appeared to be accustomed to this sort of mission, while Lt. Greyell and I were nervous and apprehensive on our first mission. I noticed that some of the other boys who had come over with me – 2Lts John W. Yingling, Mel Souza, W. C. Sankey, Pete Nibley and Jim Horsley – appeared to be nervous after some of their germ missions. I respected their nervousness, however, and did not question or tease them about it. I also respected the secret classification placed on the subject of germ warfare.

From their expressions and attitudes, I would say that Lts Harvey and Padgett had five germ warfare missions to their credit each. Lt. Greyell had only one to my knowledge. Lts. J. B. Armstrong and M. Satenstein had three germ missions apiece. Lts Jim Horsley and Pete Nibley had two missions of this type. They appeared to have become accustomed to the idea that they were carrying germ bombs.

I know of only one pilot, 1Lt. C. O. Armstrong, leader of H flight, from the 67th Squadron who has sprayed germs. Around the 18th of February, I saw

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the spray truck going down the runway spraying the ground behind an aircraft, and this was the only occasion that I observed this. I don't remember whether this was on the same day that 1st Lt. C.O. Armstrong sprayed germs or not. When taxiing out for take-off, I have seen the four spraying aircraft parked at the north end of the field.

The 18th Group, which consists of the 2nd South African Air Force Squadron, the 12th Fighter Bomber Squadron, the 39th Fighter Bomber Squadron and the 67th Fighter Bomber Squadron, apparently already had an operational policy for dropping germ bombs set up in January 1952, for when I arrived the procedure had already been established. From my knowledge, I would say that such a policy would take at least 1 month for planning, preparation, and training. This would mean that the 18th Group must have been dropping germ bombs since the middle of December, 1951, or perhaps even earlier. Judging by all signs, the decision by the American forces to use germ warfare in Korea was made early in the fall of 1951. This would allow several months to get the necessary personnel and equipment into the theater and to set up the policies and procedures to be used in carrying out the germ warfare.

Our Group Morale on Germ Warfare Missions

Due to the germ warfare missions, the morale of the group was becoming lower because I am sure that every pilot was not willing to fly the germ warfare missions. The pilots would usually be talkative before the regular mission, going out to the planes,

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telling about the mission after it was over, etc. However, after a germ warfare mission, the less said the better it would be. The pilots would say where they had been on the mission, but none of the usual details such as flak encountered, number of hits with bombs, etc. would be volunteered as was the usual case. When talk would begin on the day's missions, those who had had germ warfare missions would be conspicuous by their silence. The only mention of these missions would come as a slip of the tongue in general conversation or else when alone with a very close friend. If such mentioning of these germ warfare missions came up in general conversation, everything would become quiet for a few seconds and then the topic of conversation would be quickly shifted to another subject.

I remember going to see 1/Lt. R. L. Michael, who was in the hospital, shortly after my germ warfare mission. He asked what I had been doing and he guessed from my looks and answer that I had been on a germ warfare mission. He said "In a way, I'm glad I'm in here (the hospital) and not out flying missions with you boys." He had only flown two or three missions before he was injured in a take-off accident. I knew him to be a person of strong religious sentiments, so I knew that he was not anxious to get out of the hospital and perhaps have to fly germ warfare missions. I told him that I wasn't exactly happy about everything and he said that he could sympathize with me.

After a germ warfare mission, those pilots who had flown on the mission would seem gloomy

for the rest of the day and would usually be found in the club trying to drink away their trouble. The topic of conversation at their table would usually be the sad state of affairs which the government of the United States is now in. I remember the conversation of Lts Harvey, Padgett, Greyell and myself on the night of February 15th, after our germ warfare mission on that day, was how we'd like to see Truman flying a Mustang over Korea. This thought proved to be funny and we promptly dubbed Truman as another "George two". The term "George two" was applied to Col. Levinson the group commander, when he wasn't around. He had flown on a mission with George flight as number two man. He became flustered over the target and threw his bombs away. The flight leader told number two to lead the flight back to the base, but Col. Levinson, the number two man, replied that he wasn't sure of his exact position. This incident caused no little amount of laughter behind the colonel's back, and the nickname "George two", which is an uncomplimentary name, has stuck to him. The four of us at our table in the club had the table to ourselves, for the other pilot apparently decided to let us get over our mission by ourselves. This was the custom, for we all respected the feelings of those who wished to avoid the subject of germ warfare or not be reminded of their recent part in it.

The following incident occurred at the Officers Club one evening in the middle of February. 1st. C.O. Armstrong was asked by someone at the next table what he had done that day. He

replied in a rather loud voice, for he had had several drinks: "I wasn't spraying bacteria today, that's certain". Lt. Col Crow, the 67th Squadron commander, was sitting at our table, and he immediately got up and went over to the table and took Lt. C.O. Armstrong outside and talked to him for about fifteen minutes. Lt. Armstrong left the club and went to his tent. The group in the club was quiet for a moment after the incident and then someone called for "more beer" and talking was resumed, with everyone closely watching what he was saying.

I cannot say how the enlisted men reacted to the subject of germ warfare for we had little contact with them. I do know that the crew chief would usually be talkative while you were getting in the plane, but on the morning of February 15th, my chief only said "Good Morning". Usually the crew chief would ask the pilot to "Please bring this plane back — we don't have many of them" and other such remarks, all in a good-natured manner.

The policy of being careful what one said naturally put a strain on most of the pilots, for discussion was usually very free and frank on all subjects, except bacteriological warfare, of course. However, the germ warfare missions did serve to lower the morale of the pilots and the group as a whole.

My Conscience Wants Me to Speak Out

We know that the aircraft which carried out the germ warfare missions in Northeast China would be the F-80s and F-84s and F-86s. They

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operated generally in the area between the Chong-chong and Yalu Rivers. These aircraft are fast and maneuverable and can reach the Northeast China area easily from their bases in South Korea. These aircraft also would stand a better chance of survival in the event that any MIGs were encountered on the mission as they are faster than the F-51s. There would be F-86s flying top cover or protection for the F-80s and F-84s in the event that any MIGs made an appearance and threatened them.

In my opinion, it was apparent that the American forces had chosen winter time to start using bacteriological warfare for the purpose of using Korea as a testing ground to test the cold-withstanding bacteriological weapons developed in our special laboratories. The final purpose is to use them in bacteriological warfare against the countries with cold climates such as the Soviet Union and the People's Democracies.

From these facts, I testify that the American forces have waged germ-warfare in Korea for over half a year now. This was done even while the peace talks were in progress. It is a difficult thing for a pilot to do, dropping these germ bombs on innocent civilians and taking part in this inhuman type of warfare; but he has no choice but to do as he is told, even though it means dropping these terrible weapons upon the North Koreans and the Chinese People's Volunteers. The use of germ warfare is against all humanitarian principles, and all the peace loving peoples of the world are against it. Americans should speak out and con-

demn those who made the decision to use this inhuman weapon. It is the duty of everyone to do his part to stop germ warfare at once, before any more of these innocent people are killed by this terrible weapon. All men of righteousness the world over, and especially the Americans, must stand up without any hesitation against this inhuman warfare!

Floyd B. O'Neal
18 June 1952

HOW I FEEL ABOUT BACTERIOLOGICAL WARFARE BEING WAGED BY THE U.S. FORCES IN KOREA AND NORTHEAST CHINA

From the standpoint of an American citizen, I cannot see any justification whatsoever for the using of bacteriological warfare weapons against the peoples of North Korea and Northeast China. There is no need to use such terrible weapons of mass destruction against the civilian population of these countries. This type of weapon is one of the most inhuman weapons ever used against civilization—a type of weapon which was specifically banned by the Geneva Convention. The United States supposedly adheres to this convention, or at least it did for some time. Not even the Nazi fascists dared to use this terrible weapon but now the United States forces are using it freely and openly. One of the main reasons that American citizens denounce bacteriological warfare is the fear of retaliation, for no American wants to see the United States attacked by forces using bacteriological weapons.

The American people have placed men in the high government offices who are not obeying the wishes of the people, for the people do not authorize bacteriological warfare. They are against it, as are all of the peace loving people all over the world. When all of the facts reach the American people, they will denounce the imperialists and replace them with better leaders who will obey the wishes of the people.

The members of the armed forces of the United States have to lay aside their personal feelings on such matters and carry out the orders given to them by their commanders. This outlook has been so instilled in our fighting forces that it has become habit not to question an order, but to carry out the order first and then think about it. This system of discipline is necessary in order to commit such acts as those involved in bacteriological warfare. This type of blind, dumb obedience enables men to be ordered to do things which they may personally hate, but discipline has become so strong that they carry out the orders without thinking of the consequences. Another factor in the Air Force is that everything is sort of remote—the ground where the germ bombs hit is thousands of feet below and the aircraft crews never see the results of the bombs which they drop. Still, if one has a sense of righteousness, one cannot help but meditate upon the things which he has done. As one having taken part in germ warfare, I can say that it is a most unpleasant feeling to think about your actions in this type of warfare. Flying over the target and pushing buttons to drop the bombs requires only training—it requires no thought. If it were possible to train monkeys, they could do this work as well as any human. And the monkeys wouldn't think anything of it! I did not advocate bacteriological warfare—I did

not wish to participate in it. But when the orders came, I did exactly the same thing as every other pilot. I obeyed the orders and tried not to think about what I was doing and what terrible destruction I was bringing to those innocent people thousands of feet below me. I cannot justify my actions in the least, for such is impossible. And the realization of my part in this warfare does not put my mind at ease. I cannot understand why the decision was made to use bacteriological warfare in Korea—let alone China. Those who made the decision must bear the consequences which this decision will bring down upon them, and those of us who carried out their orders must realize our part in this war against civilization!

How did bacteriological warfare come into being? Who in the civilized world would perfect such terrible weapons? I think that Joan Chase Hinton described these people properly as "madmen locked in laboratories thinking up new ways to destroy the world!" Science should be for the benefit of mankind not the destruction of people; science should devote its entire effort toward finding cures for diseases, not thinking up new diseases and ways to spread these diseases. Those who have studied science and are now bending their minds to the destruction which science can bring are discarding the spirit in which so much knowledge of science was given. Certainly a doctor would not want to kill off all of his patients—rather he should do his very best to save them. Why then do some scientists try to kill off their patients, who are the people of the world who can be cured of wants and sufferings if these scientists will but turn their efforts toward peaceful endeavors and research?

Those American scientists who are working in bacteriological warfare know exactly what they are doing—they have forgotten or choose to forget the high ideals which inspire every man to do his best to aid mankind. These men are dragging the term science in the dust—they have become servants instead of making science become a servant of mankind. The consequences of the work of these men are terrible and these men shall have to remember that they could have prevented much of the misery caused to the people if they had but refused to do such work. These scientists are not military men—no one gives them orders to do this type of work. Yet it is done and they glory in the results. Their glory shall be shortlived. Those American scientists who are now working in laboratories on research or production shall not be forgotten, for these Americans are shaping the destinies of people the world over with their hands as they work.

What can be done to bring a halt to the use of bacteriological warfare? The people of America can join with the peace loving people of all countries and demand a stop to this inhuman type of warfare. If

all of the people join together their voice can be heard—and will be heard if they will but speak up. The government cannot ignore all of the people; for the people united together have more power than any form of government.

The use of bacteriological warfare is one of the biggest detriments to world peace. Its use threatens our very civilization. This type of warfare is against all known humanitarian principles. The peace loving people of every country condemn this type of warfare and the people who gave the orders to use it.

Summarily, I denounce the use of bacteriological warfare from the standpoint of an American citizen and from the standpoint of a member of the U.S. Air Force. Having been ordered to take part in bacteriological warfare, I have done so, but I cannot be ordered to say or think that such warfare is necessary, because it isn't! Why use these inhuman type of weapons against innocent civilians in Korea and China? There is no need for this type of warfare, no matter what excuses may be thought up. It is against the people that these bacteriological weapons are directed, and I have no quarrel with the people of Korea or China. Bacteriological warfare can be stopped and must be stopped. Scientists must turn from destructive work to peaceful, production work for mankind, and turn science into a tool that is used for the benefit of mankind. The American people must join hands with the peace loving people of other nations and remove from office those officials who try to justify this means of warfare. Only in this manner can this grave threat to mankind and civilization be eliminated.

Yet bacteriological warfare is still being waged by the U.S. forces in Korea and in Northeast China. This horrible type of warfare still goes on, taking the lives of more and more innocent people. This germ warfare must be stopped. The people of America must realize the seriousness of these terrible weapons, and rise up together and stop this germ warfare. Only then can all mankind know peace!

Floyd B. O'Neal (signed)
30 June, 1952.

AN OPEN LETTER
TO THE PILOTS IN THE 18TH FIGHTER BOMBER GROUP
IN SOUTH KOREA

Although this letter is addressed to the pilots in the 18th Fighter Bomber Group, its message applies to every U.S. Air Force crew member who flies over Korea.

Some of you in the 18th Group will remember my name. You may even remember that I was shot down over North Korea on March 4th. The MIA now placed after my name isn't quite right. I'm not missing—I'm still very much alive! My crash landing was only the beginning of a new chapter in my life. And I might add that it is the most important chapter in the book.

All of you will probably agree that you are all fine. Now I ask you: Are you happy? Do you enjoy dropping germ bombs on the people of North Korea? Does your mind let you do this and still feel at ease? I think not, I know that the memory of my bacteriological warfare mission is emblazed on my mind. I can't forget it. And I don't believe that any of you are black-hearted enough to forget it or shrug it off as a wartime necessity. Who among you likes the idea of seeing your native country ravaged by bacteriological warfare? None of us want that. Then why are we doing it? Surely not for that one hundred bucks we call flying pay. Or are you willing to sell your soul at this alter of blackness for one hundred dollars per month? And don't forget, my friends, that not all of you will be around to collect next payday!

And now some of you are wondering why I've written this letter. I'll tell you. I've got to write it because my conscience tells me to. My sense of righteousness forces me to speak out. I'm writing this because it's high time this madness which is infecting the world is brought to a screeching halt. Since my capture I've received nothing but good treatment at the hands of the Chinese People's Volunteers. I have learned of the horrible things our forces have done and I have seen with my own eyes the bombed-out towns and villages. Our own POW camps aren't even safe. Now some pilots, I don't know who, have dropped germ bombs on the POW camps. Is that any way to treat your own countrymen? I appeal to the human instinct which I believe is inherent in every man.

Stop this brutal killing and stop it now! There is no need for one single bomb more to fall on Korean soil. Any idiot can learn to fly and drop bombs. But you are human beings, supposedly endowed with a mind capable of thinking and a soul to guide you. Is this soul guiding

you when you drop germ bombs? Or are you guided by the hollow words of those who tell you that germ warfare is a "human" way of killing? Any way you look at it, the answer comes out the same—germ warfare is the lowest, most brutal, and most inhuman type of warfare known.

The main sufferers in this war are the innocent civilians of Korea and Northeast China. These people did not ask for this war. They hate it. Every part of their daily life has been changed due to this madness called a "police action". And you in your fine "police" uniforms are killing and wounding these innocent people who have done you no harm. Is that the way to spread good-will?

What can you do? You say you're only doing as you are told? Now hear this. Stop and think. And be fair with yourself. Every one of you down to the last man in the back row should simply stop flying germ warfare missions. One thing is certain (and this is a mathematical fact): no pilots to fly germ missions equals no germ missions. And here's another morsel: they can't court-martial the whole group. Speak up, boys, and make yourselves heard! Get together and act together, and the germ bombs that you **don't** drop "will be heard around the world."

You say I'm just a POW sitting back in the safe zone of North Korea watching the show, I've got news for you. Those germ bombs you're dropping show no respect whatsoever for POWs. And the "show" I'm watching is disgusting and revolting. When the time of reckoning comes, there will be no skirts to hide behind. Every man who has participated in germ warfare must realize his part. Don't you realize that the piper is piping the tune of death? Are you so dizzy from dancing to this tune that you've lost your power of reasoning?

Look at it this way. You want to return home to your families. So do I. And we all want to live in a peaceful world. Now here's the answer. Step number one. Stop waging germ warfare! On this fact alone hinges the whole solution to our problem. Then a peaceful settlement of the Korean war. Very simple, huh? Yes it is very simple. And so easy to do—IF YOU would but take the necessary steps. On **you** depends the final solution. Are you going to do humanity this wonderful service? Time alone will tell. Think for a moment of a world where there are no bombings, no bacteriological weapons dealing death to the people. Is the answer not clear? Take the right path and be firm. You won't be only doing yourself a favor you'll be helping me and all humanity. The end does not justify the means! Think of the future of your country and speak up. "Now is the time, you are the one!"

I can do no more than to ask you, to beg you, to implore you to take corrective action. I can only fight with words. I've been trans-

ferred from the 18th Fighter Bomber Group to 1st Peace Fighter Group. And I shall anxiously wait for you to act and do your part in bringing this whole "show" to a good ending.

Let's change the tune of the piper and dance to the tune of peace. And such a glorious, harmonious tune peace will bring. This is no time to turn chicken-hearted. Speak! Act! And your efforts for peace shall be blessed.

My personal regards to those of you whom I know—and my personal request to you to take this cause to heart.

Sincerely,

Floyd B. O'Neal (signed)

15, July, 1952.

APPENDIX NN

Testimony of Lt. P.R. Kniss Concerning His Participation in Bacterial Warfare Waged by the American Forces in Korea (ISCK/5)

This Inhuman Warfare must be stopped

My name is Paul R. Kniss and I am a member of the United States Air Force Reserve. My rank is 1st Lieutenant and my serial number is A0 1909070. I was born April 29, 1927 in Monmouth Illinois. My Wifes address is 1103 Southwest Military Drive San Antonio Texas. My Parents address is, 339 So. 7th Street Monmouth Illinois.

In December 1946 I enlisted in the Air Force as a Corporal. Later after graduating as a pilot, I served as a flight instructor at Craig Air Force Base. I remained at Craig untill January 30, 1952 when I was ordered to Korea. I arrived at Camp Stoneman, California on the 21st of February, 1952 for further assignments overseas, together with 5 other instructors from Craig who were also going overseas. Their names were 1/LT John Carleton, 1/LT John Jansen, 1/LT James Camp, 1/Lt Robert Manning, and 1/Lt Randall. From Camp Stoneman we were sent to Korea. We arrived at K-46 (F-51 base about 5 miles North of Wonju) on the 20th March 1952. I was assigned to the 12th Fighter Bomber Squadron 18th Fighter Bomb Group flying F-51s.

In June 1951 while I was still at Craig, I attended a lecture in Flight room of our Squadron. All the pilots of 3616th Pilot Training Squadron were there.

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Our lecturer was a Captain Laurie, our Wing Information and Education officer. He talked for about 1 hour on Atomic defense. He went to great detail to explain our defense against Atom bombs on the ground. He stated an atom bomb did no more damage than a normal bomb only that it destroyed a larger area. Our means of protection was to get down on the ground or under a table or against a wall to protect ourselves from the blast. He stated the blast would kill a person 3/4 of a mile away if he were not behind something, the radiation was safe if you were half a mile or further from the bomb. He stated the heat would kill everyone 1/4 mile from the blast.

He then said the real danger was the germ warfare being planned by other nations. He said they would bomb germs and also be smuggled in by agents, fired in artillery shells from submarines. He stated he expected to see in 1952 all military personel having to attend special courses in germ warfare, being issued protective masks and would be given special innocculations against germs. Pilots of our Squadron asked him where he had gotten this information, but he would not say where, only that we would be told more later on.

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The day after we reached Camp Stoneman, that is on February 23, the six of us new arrivals with others who were going to different groups in Korea, were given a 15 minute briefing by Captain Holleman. 1/Lt Charles Brooker a classmate of mine at Barksdale Air Force Base Louisiana also attended this lecture, he was going to fly B-26's in Korea. All together there were 50 pilots at this lecture. Captain Holleman is about 35 years old, wore glasses, about 6 feet tall, dark haired, and getting bald on top. He stated that there were stories circulating to the effect America was using germ Warfare in Korea. These stories are untrue, he said, and our job was to deny these stories. America has, he says germ bombs and they can also spray germs from airplanes but we are not doing it and want you men to deny every story you hear about germ warfare. We have now in America a V.T. germ bomb (with variable time fuze) and we also have a parachute bomb for germ warfare. This latter bomb is loaded with diseased animals and insects which will, when rele...

from the bomb, spread their diseases around. We can also spray germs direct from airplanes. We can also have them carried into enemy territory by our agents who could put the germs in the water supply of all the towns and cities. Captain Walleman gave us all this information in our processing room at Camp Stoneman. After this lecture was over myself and the other pilots in my group discussed it among ourselves. I was of the opinion as were the other men, that we were not using germ Warfare in Korea, that it was propoganda being circulated by the North Koreans. We thought our government naturally wanted to stop all stories circulating to this affect.

Again the very day after our arrival at K-46 in Korea, we six pilots, Lieutenants Carleton, Jansen, Camp, Menning, Randall and myself were given a 1 hour lecture on March 21 by Captain M^c Laughlin. He is about 30 years old, and about 6 feet tall. He is our Group intelligence officer and the briefing was held in our briefing room with the door locked. The 18^th Ftr Bmr Group has been waging germ Warfare since January 1st 1952, Capt. M^c Laughlin stated. We are using two types of bombs at present, a V.T. germ bomb and a animal parachute bomb. We are going to start spraying germs from our aircraft in June. We will send four aircraft from our Group the 30th of April, 1952

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to Tachikava (Japan) to be fixed up for germ spraying. They will put a tank behind the pilot to hold the germs and they will spray out behind the aircraft. The aircraft will be ready the 15th June and then we will brief all the pilots of the group on how to spray germs. This method has been used in Korea and was successful.

In our V.T. bombs Captain Mc Laughlin stated, we will use deseases like typhoid, bubonic plague and so forth. I think he mentioned Malaria but I can't recall for sure. These bombs will come from Wonju in a special truck and will be loaded 15 minutes before your takeoff time. (Ordinarily our aircraft are loaded two hours before takeoff time.) You will know what they are when you see the truck which is a closed one. The aircraft will be loaded by a special crew from the ordnance department and the men loading will wear white uniforms, masks and gloves. Do not be afraid of these bombs. You will not wear any special equipment but the germs cannot escape. The aircraft will be sterilized when you return from these missions.

We do not use any special aircraft for germ warfare missions he continued, but use whatever are available. When you return from such a mission you will take a shower immediately after debriefing and the following day you will be given a blood test to see if you are alright. If for any reason you cannot complete your mission you will not drop your bombs but return to K-46 and land with them. You men will not talk about germ

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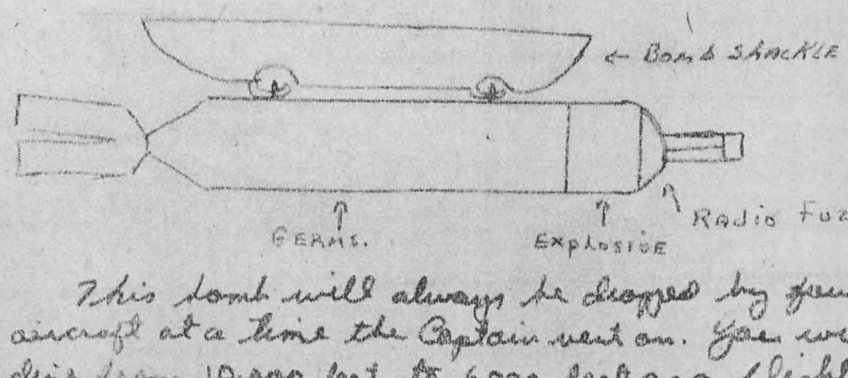
warfare at any time and will always report after a germ mission as I shall instruct you. You will sign a statement after this meeting saying you will not discuss among yourselves or with anyone, the contents of this meeting. The material in this lecture will be considered "Top Secret." Our Government will deny the facts of germ warfare as long as possible. Do not feel bad about using germ warfare as all other pilots in the Group are doing it now and it will increase later on.

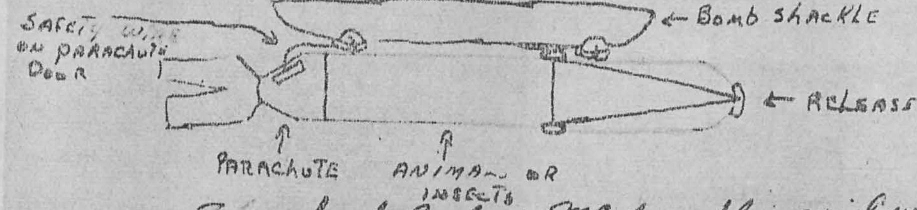
Here is our V.T. germ bomb as Captain McLaughlin drew it on the blackboard.



This bomb will always be dropped by your aircraft at a time the Captain went on. You will dive from 10,000 feet to 6000 feet as a flight and release your bombs at the target. The bomb will explode about 100 feet above the ground and spread the germs for around 100 yards. If the bomb does not explode in the air but, explodes on the ground the germs will be killed by the blast. If the bomb explodes in the air the germs are just spread out by the force of the explosion.

This bomb will be dropped close to a city but not in it because the North Korean people have used dis-infectant widely in their cities and it would kill the germs. We drop our bombs close to a large city and let the animals and humans carry the germs to the city, where they will spread, but these germs must get on animals or humans within 3 hours or they will die. These germs Captain M^c Laughlin stated are parasitic, meaning they cannot exist by themselves but must live on something living, they can exist for about 3 hours by themselves. When you return from a mission if it was sucessfull you will report "Mission accomplished. Results unobserved," that is so we can say it was "Flack Suppresser" mission in our releases to the newspapers. The bomb Captain M^c Laughlin said looks like a regular 500 pound U.S. bomb and has no special marking on it.

This is our parachute bomb as drawn by Captain M^c Laughlin.



The bomb Captain M^c Laughlin said will only be carried by one of the old Pilots in the Group. He will be the only one of the Group carrying the bomb on a Group formation. He will dive with his

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flight from 10,000 feet to 1000 feet and release them. The door will open in the rear of the bomb and the parachute will lower the bomb gently to earth. When the bomb strikes the ground, it will break into two Parts, at the position where the hinges are located. The bomb was originally cut into two parts then joined together by hinges. When the bomb breaks into two parts the animals or insects will escape. We are using rats, lice, mice and fleas in these bombs, It will also be dropped near a large city but not in it where the people could kill the animals or insects as they escape. This bomb will be reported as a dud when the pilot returns from his mission. You can reconize this bomb by the door in the rear, the hinges in the middle and where the bomb has been cut in two. With both types of bombs you must not fly over 12,000 feet or else the animals, insects or germs will be killed due to lack of oxygen and the extreme cold. Again" Captain Mc Laughlin said" I want to tell you men not to discuss this information out of this room as you will be court-martialled." With these words, he concluded our briefing. Our briefing lasted from 08:00 till 09:00.

There were the following named men present. Myself, 1/LT John Carleton, 1/Lt John Jansen, 1/LT Robert Manning, 1/Lt James Camp and 1/LT Randall. We had all been instructors at Craig and had joined the Group at the same time.

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Captain Mc Laughlin brought the statements that we signed to the lecture, and at the conclusion of the lecture gave each one of us one to sign. We then returned the statement to him. The statement was about 10 inches long and 2 inches wide, as Best I remember it, it was worded as this.

I UNDERSTAND I WILL NOT DISCUSS ANY OF THE INFORMATION DISCUSSED AT THIS MEETING 21 MARCH 1952 AND IF I DO I MAY BE PUNISHED
DATE
UNDER THE - ARTICLE OF WAR.

Paul R Kniss
SIGNATURE

I forget the exact number of the article of War it mentioned.

The Group intelligence Officer will keep this statement in his office. If any of the pilots were over heard discussing germ bombs they would be court martialed and this statement would be used as evidence against them.

I was very disgusted myself at the prospect of having to wage germ Warfare, but I also realized I had no choice in the matter but must do as I was ordered. I remembered also the words of Captain Holdeman whom I had believed and at this time I was starting to wonder who was right, and who was wrong in this War.

The 27th of March 1952, at 05:30 myself, Captain Thomas (our Flight leader) Captain Bruton and 1/LT Fleck all of whom were in the 12th Ftr Bmr Squadron were briefed for a germ mission. We were briefed by Captain Mc Laughlin in our Group briefing room with the door locked. Captain Mc Laughlin showed us a photograph of some

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hills with bare spots on them South of Sariwon, 10 miles. These pictures were about 12 inches long and 8 inches wide and had been taken by the 67th Tactical Reconnaissance Group. The bare spots on these hills, he said are gun positions. I looked at the pictures with a magnifying glass but could see no guns or gun positions. Your mission is a "Flack Suppressor mission" Captain McLaughlin said. You will take off at 07:00 and be over your target at 08:00. You will climb to 10,000 feet on course to the target. When you are over the target, dive as a flight to 6,000 feet and release your bombs. When you return report to me and say "Mission accomplished with results unobserved."

Our briefing lasted for 15 minutes. After briefing I went to my squadron Operations room and put on my flying equipment. At 06:45 I went out to my airplane. Two men dressed in white fatigues, wearing a mask over their nose and mouth, and gloves were loading the bombs on my airplane. They removed the bomb from the truck and placed them on the bomb shackles by hand. The bombs looked like regular 500 pound U.T. bombs and had no strange markings on them. When they had finished and drove away, I looked at my bombs to see if they were securely on the bomb hooks. My plane like the other 3 planes had two 500 pounds U.T. germ bombs on it.

We took off at 07:00 and climbed on course to 10,000 feet. We arrived over our target which was 10 miles South of Sariwon about 100 feet to the side of the railroad track, at 08:00. We dove as a flight to 6000 feet and released our bombs. Two exploded

on the ground and six of them exploded in the air. The bombs that exploded on the ground threw debris and a gray cloud of smoke up to a height of 100 feet. The bombs that exploded in the air formed a grey cloud about 100 feet feet in diameter which disapeared in about 45 seconds. Our flight then climbed back to 10,000 feet and returned to K-46. We landed at 09:00 and told Captain Mc Laughlin in the intelligence office "Mission accomplished - Results unobserved". Our flight then took a shower. While we were taking the shower, I said to Captain Thomas "This may clean my body but my mind will never be clean after committing such an act". At 08:00 on March 28th we were given a blood test by our doctor.

Other germ bomb missions which I personally knew about are as follows. On the 29th of April, 1LT Dako told me that he and 1LT Curry, 1LT John Jensen, and 1LT Randall had dropped 8 V.T. germ bombs, 5 miles South of Sinanju the 5th of April. (All these Pilots are in the 12th Ftr Bmr Squadron). He also said that Lt. Col. Crane, our Squadron Commander (12th Squadron) had dropped two parachute bombs the 15th of April, 5 miles east of Sanchon. The 5th of May at 09:00, I heard Lt. Col Crow, squadron Commander of the 67th Squadron, tell Captain Mc Laughlin he had dropped 2 "duds" near Pyongyang. These were the parachute germ bombs. The 21st of May, Captain Thomas told me that 1LT Earl Williams, 67th Ftr Bmr Squadron had led a flight

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of 4 aircraft to a position 5 miles east of Kunari on a "Flack suppress" mission. We knew then that they had dropped 8 V.T. germ bombs.

I want it known by whoever reads this statement that it is my own sense of justice, my own ability to tell right from wrong has forced me to let everyone know the facts. My Conscience has always bothered me since I've committed this act as I believe it would any man that knew justice from injustice. This inhuman Warfare must be stopped. I offer these facts to the world that an inhuman weapon is being used in Korea by the United States forces. It is not only being used against the North Korean and Chinese Volunteer soldiers but also against the people of North Korea. The civilians of North Korea have suffered terribly from the War already and now they are being subjected to the most inhuman type of warfare. It is now the job of all the people in the world to take these facts that I have presented and demand an immediate stop to germ warfare in North Korea. The people of the United States should insist that no nation should ever use this type of warfare again. Only by every person in the world doing their part towards stopping wars and inhuman acts will we have world peace. All men of the world are brothers and until we all learn to live together and help each other we cannot have the world peace we desire so much.

Paul R Kniss
20 July 1952

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COMMENT BY THE EDITORS ON THE TESTIMONY OF KNISS

On the face of it there appears to be a number of contradictions between the evidence of Kniss and that of O'Neal, especially as both are from the 18th Fighter-Bomber Group, both were flying F-51's, both were briefed by the Group Intelligence Officer Captain McLaughlin. Important points of agreement between the testimonies of these two pilots are:

1) Both were briefed on germ warfare by Capt. McLaughlin in small groups immediately on arrival at their base. O'Neal was told it was policy for McLaughlin to brief all pilots on germ warfare as soon as they arrived.

2) The methods to be used, namely the V. T. bomb for germs, the parachute bomb for germ-infected insects and small animals and spraying germs direct from aircraft.

3) The need for secrecy.

4) The height from which the V. T. bombs were to be released, O'Neal said he dropped from 7,000 feet, Kniss that they were ordered to drop from 6,000 feet.

5) The fact that artillery shells could also be used in germ warfare but that germ bombs were more effective.

6) That special crews would handle the loading of the germ bombs.

7) That there would be a special way of reporting results of missions and that Captain McLaughlin himself would be on hand to take the debriefing reports.

Points of disagreement are as follows:

1) O'Neal was told it would not matter much if the V. T. bombs exploded in the air or on the ground, that the bacteria would survive. Kniss was told the explosion would kill the bacteria if the bombs hit the ground, but they would survive if the bomb exploded as scheduled at 100 feet above ground. (Both agreed that the V. T. bombs would be set to explode at 100 feet above the ground.)

2) Kniss was warned not to fly over 12,000 feet as the germs and insects would be killed by lack of oxygen or the cold. O'Neal was not briefed on this point.

3) O'Neal was told the germ bombs would be dropped over towns or areas with large troop concentrations while Kniss was briefed to drop

on the edge of towns and cities—from 5 to 10 miles outside as is shown by the actual missions in which he participated or had knowledge.

(In connection with these three discrepancies, it is important to note that Kniss was briefed just two months after O'Neal. The U.S. forces must have realised by this time that germ warfare, already in progress for at least 3 months, was not producing the results that had been expected. It seems logical to expect that the experts cast around for every possible explanation for the lack of success, and that by the time Kniss was briefed there was an attempt to eliminate any unfavourable factors. The U.S. forces had found that germ warfare was not as simple as had first appeared. Kniss was specifically told not to drop germ bombs on towns because of the decontamination measures taken by the Korean people.)

4) O'Neal was told in the event of not being able to drop his germ bombs in North Korea to pick some uninhabited spot in South Korea and dump them there, asking the nearest radar station for a fix so that a special team could be sent to retrieve the bombs—which should be dropped without arming the fuse so they would not explode. Kniss was told to keep the bombs aboard and return to base. (A possible explanation of this is contained in a report carried by all the American news agencies in early March to the effect that a "mysterious" outbreak of typhus had occurred in a remote, mountain village in South Korea. It is highly likely that this was the result of some airmen "dumping" germ bombs which actually did explode or burst asunder on impact.)

5) O'Neal describes spraying missions as early as mid-February and was briefed in detail about how they were to be carried out. Kniss was told spraying would only start in mid-June and that aircraft would be sent to Japan at the end of April for adaptation. Both O'Neal and Kniss are equally sure their versions are correct. O'Neal actually saw the spraying aircraft parked apart from the rest of the planes. There seem to be two possible explanations for this. (a) That the spraying as tried out at first was unsuccessful and further modifications had to be made in the methods so it was temporarily abandoned. (b) That the operational losses either of the spraying aircraft themselves were so great (or the losses of other F-51's were so great that the spraying aircraft were put back into regular combat operations) that the project had to be temporarily abandoned. It is noteworthy that McLaughlin told Kniss that spraying had already been used successfully in Korea, also that February was a month in which American plane losses were exceptionally high.

6) Kniss and the others were forced to sign a secrecy statement which was not required of O'Neal and those with him. On January 22, when O'Neal was briefed the Korean-Chinese side had made no men-

tion of germ warfare—in fact it was not even confirmed that it had been started. By March 21, of course there had been a great deal of publicity about germ warfare which as we know from discussions with all prisoners did provoke debates and discussion at the air bases. The necessity to stop such discussion would logically be more imperative on March 21 than January 22. At the briefing which Kniss attended at Camp Stoneman on February 22, he was specifically told to deny rumours that the Americans were waging germ warfare. Obviously such instructions were not necessary for O'Neal at the time he was briefed.

7) Greater precautions were taken for the pilot's health in the period in which Kniss was operating. Pilots were given blood tests following their germ warfare missions.

Conclusion: The discrepancies between the evidence of these two pilots seem merely to reflect the modification of methods introduced by the U.S. Government as they developed their germ warfare plan. (The Editors)

APPENDIX OO

Notes on Interviews with Four Captured American Airmen

These interviews took place at a rendezvous in North Korea. After a brief introduction of each of the prisoners of war by Gen. Wang Yang-Kung, each captured airman made a statement, which was followed by free discussion with the Commission. At the conclusion of this, each airman made a final statement of his own before withdrawing. The names of the American airmen were:

1) Lt. Kenneth L. Enoch (navigator)
2) Lt. John Quinn (pilot)
3) Lt. Floyd B. O'Neal (pilot)
4) Lt. Paul R. Kniss (pilot)

The two latter had not previously made any public statement.

1) *Lt. Kenneth L. Enoch* (aet. 27) of Youngstown, Ohio.

Lt. Enoch's opening statement closely followed that already published in SIA/14 and in the printed and lithographed brochure issued from Prague. He described the secret lecture given by a Mr. Wilson which he had attended at Iwakuni, Japan, with its references to air-bursting variable-time fuse containers, the direct spraying of insects from planes, the parachute containers for insects and rodents, and the infection of water reservoirs, where the ideal aircraft would be a helicopter.

Responses to questions followed.

(O) He was a reserve, not a career, officer. He did not remember ever reading anything in American Air Force general instructions and regulations concerning the international laws, customs and usages of war, such as the prohibition of the shooting of prisoners—certainly nothing which bore on chemical or bacteriological methods of warfare.

(Z) His reactions and those of his comrades when they realized that they were carrying out bacteriological warfare were

very serious. "It came as an awful blow to me that we were perpetrating such actions. I had no idea until the second mission of the scale on which it was being done. But the strict secrecy forced us to keep it very quiet, even among ourselves." Captain Amos, his pilot, a career officer, was a very moral man, and was very hard hit when he realised what was going on. It was only slowly that he understood how widespread it was. By now he had probably finished his quota of 55 B/26 missions, and had gone back to the USA.

(O) From the lectures which he had attended, he did not get the impression that everything as regard to bacteriological warfare was still in the experimental stage. On the contrary, these armaments seemed to be ready.

(M) Yes, indeed, he was quite willing to say something about his position in civil life. After he had graduated from High School he had entered one of the steel mills of his home town as an ordinary worker, and thence joined the Air Force in 1943. He served for 45 months, carrying out 21 missions in B-24's, of which 16 were in China and 5 from Okinawa, against Japan. In 1947 he went back to the steel mill to earn enough money to go through college, the government bounty not being sufficient. He duly took electrical engineering at Youngstown College, and after a two-year course, took a post with the local Electric Power Company. He was recalled to the Air Force in Sept. 1950 and rejoined at Langley Field.

(N) Yes, his previous experience in China was relevant. He had been stationed at Luliang Airfield in Yunnan Province, east of Kunming. The town was three miles away, and very poor. The airmen only went there two or three times to buy souvenirs, and had very little contact with the people, who however were friendly. They got along well with them and marvelled at their farming methods, which seemed to the Americans very primitive. They also marvelled at the massed Chinese labour power which had created an 11,500 ft. runway all levelled by hand. They did not realise anything at that time of the economic conditions of the Chinese people. In spite of these former experiences, he was afraid of being captured when he had made a safe landing after parachuting out from his plane which had been hit and made uncontrollable. He imagined that he would be tortured and perhaps

shot, but "after they had taken away my gun, they shook hands and gave me a cigarette, and gradually I realised that they were the same friendly people I had known at Luliang." This reassured him very much. Since that time, he had been very well treated, indeed "all our contacts have been really brotherly." He was deeply impressed not only by the things which had happened to him personally, but "by all the inspiring things you learn about the country itself". The liberation and the new government had brought about a radical change for the better, and if only the American people could be gotten to understand this they would enthusiastically give to the Chinese people all the help and support that they deserve.

(M) As to whether he had ever thought about politics in former times, it was necessary for the members of the Commission to understand what politics were like in America. Ordinary people there took no interest in them. They felt that politics was mostly racketeering, and that no one would ever be able to clean it up. As for foreign affairs, they seemed to be arranged by some mysterious forces which the ordinary man in the street felt that he would never understand.

Yes, of course he had great respect for military discipline. It would not have occurred to him to dispute orders. Besides, it was known that drastic measures had been taken against some men who had refused to serve in Korea; though not actually shot, life had been made very unpleasant for them. He admitted that one might have to dispute an order on some relatively unimportant matter, but few indeed would dare to do so on an important thing. Moreover, at that time relatively few bomber pilots or crews were being shot down, and there was a very reasonable hope of being able to complete one's quota of 55 missions, and so to be free to return home. He personally simply hoped that he at any rate would not be ordered to drop any more bacteriological bombs.

(O) No, he knew of no types of containers suitable for the delivery of biological materials other than the air-bursting variable-time fuse bomb (herein-after called the VT fuse bomb). At least he himself had seen no other kinds.

(Z) In the lectures which he had attended, there had been no mention of any experiments or attacks conducted by the Japanese during the second world war.

Concluding Remarks:

The witness wished to say that he now felt he had been serving madmen who were throwing down a terrible challenge to the world's peaceful populations of men, women, and children. He resented that he had had to do their dirty work for them. Bacteriological warfare would bring misery, pain, sorrow and death into millions of the world's homes. His righteous conscience moved him to accuse and denounce those men who had prepared it. He stood firmly on his intention to fight against this kind of thing, come what might. He called upon the Members of the Commission to make their voices heard especially among the American people, who, once they knew the truth, would, he was certain, rise as one, and repudiate their government's actions. He ventured to commend the Members of the Commission who had come to Korea at considerable risk to life and limb in order to investigate the evidence. Both they and he must at all costs make work to ensure the safety of all peoples and races and their children from this new and horrible method of war. If these voices could be heard, truth would triumph.

[The Commission's Chairman for the day then shook hands with Lt. Enoch, thanking him warmly on behalf of the Commission for his sincere cooperation. He expressed the hope that peace would soon come to East Asia, and that the witness would then be able to return home to a fruitful and successful engineering career.]

2) *Lt. John Quinn* (aet. 29) of Pasadena, California.

Lt. Quinn's opening statement followed exactly that already published in SIA/15 and in the printed and lithographed brochure issued from Prague. He described the secret lecture which he had attended given by a Mr. Ashfork, with its significant references to the mechanical transmission of bacteria by insects, the proposal to drop rodents, and the intention to use encephalitis.

Responses to questions followed.

(A) His reasons for joining the US Air Force were complex. All his past experience since 1939 had been military. His brother had been killed in an air crash in California, and as they had been very fond of each other, he had conceived the desire of mastering the types of planes which his brother had flown. Lastly, he had never been very successful in civil life.

(O) His change of heart after he had been taken prisoner was also complex. He had always hated what he had been ordered to do in the carrying on of biological warfare. But afterwards he had been greatly enlightened by the kindness of the Chinese Volunteers, and during captivity he had studied many books on history, economics, politics, etc., subjects of which previously he had not had the slightest idea. He had thought that America must always be right; he now thought that this was by no means always necessarily the case.

His decision to place his duty to humanity above the duty of a soldier to keep military secrets even in captivity, had cost him a great effort. He did not, however, as the questioner suggested, fear reprisals against his family in the USA. He had not lost his faith in the American people, and did not believe for a moment that anything would be done against his family.

Of course it had been a great struggle to overcome his scruples.

(Z) The reactions of his fellow service-men were just the same as his own. Instructions to carry out bacterial warfare had come upon them rather suddenly and they were in it before they could summon up enough moral courage to protest actively against it. Some of them argued that high explosives had been bad enough when they first began. It seemed difficult to protest against bacteriological warfare unless one protested against all indiscriminate weapons.

(N) He did not remember ever reading anything in US Air Force regulations and general instructions which outlined the accepted usages and customs of war, such as the prohibition of shooting of prisoners. He knew, however, that bacteriological warfare was outlawed, at least by some nations. In any case, he had a very strong impression that if anything had been questioned along these lines, his higher officers would have said, "Such regulations don't apply to communists." That was the general atmosphere.

(M) As regards the altitude and airspeed at which he had been instructed to drop the bacteriological bombs, it was really as low as 200 ft. and about 160 m.p.h. In order to slow down to this he enriched the mixture and changed the pitch of the

propeller blades. He did not use wing flaps. The normal speed of a B-26 bomber would be well in excess of 200 m.p.h.

"Checking" meant simply verifying that the pins of the bombs had been taken out so that they were "armed" ready for their descent.

(N) He knew only two types of bombs for delivering biological material (a) that with several doors which opened after impact by battery-driven machinery, and (b) the VT fuse leaflet container which opened in the air. A Captain had explained to him that there was a small propeller in the nose which activated the doors while the container was still in the air, thus scattering boxes of insects about. He did not think that he had ever carried any of this type.

Concluding Remarks:

The witness said that he would like to add a few remarks as an American citizen. He was proud to be one. He was proud of the great traditions of the American people, the sacrifices they had made to build up their great country, and for other noble causes, but he felt now that the honour of the American flag had been soiled by the use of bacteriological warfare. Only by protesting against the use of this, he felt, could he help to wash this flag clean. He was certain that the American people would support him. As a soldier he had been forced to take part in bacteriological warfare but he hated those who had prepared and ordered it, for what happened in Korea today would certainly happen in many other parts of the world tomorrow unless decisive action was taken. His own family, he well knew, might be the target. Here he spoke with particular feeling, as on the very day of this meeting (Aug. 3rd) his wife was expecting to give birth to a child.

It could be said that the use of bacteriological warfare had shaken an international situation already in a very unstable state. The average American hated bacterial warfare, and feared it, but at present did not believe that his country was carrying it on. "When they get the truth, they will oppose those responsible as I do now." The American people were not responsible, and the Commission must provide them with the truth they needed. He thanked the Commission in the name of the American people for its work.

[The Commission's Chairman for the day then shook hands with Lt. Quinn, thanking him warmly on behalf of the Commission for his sincere cooperation. He expressed the hope that peace would soon come to East Asia, and that the witness would then be able to return to a peaceful and satisfying family and business life. He assured him that the Commission had no intention of allowing dust to gather on the evidence which it had assembled, and would take every means possible of informing the world of what had occurred.]

3) *Lt. Floyd B. O'Neal* (aet. 24) of Fairfax, South Carolina.

Lt. O'Neal's opening statement, and also some of his replies to questions followed very closely his written statement ISCK/4, here reproduced as App. MM. He described the two secret lectures which he had attended, the first at Luke Base, Ariz. by Major Williams, and the second at an advanced base in Korea by Capt. McLaughlin. He also described the bacterial bombing mission which he himself had flown.

Responses to questions followed.

(A) At the first lecture (1st Dec. 1951) the lecturer definitely did not say that the American forces were using bacteriological warfare; at the second (22nd Jan. 1952) the lecturer definitely said that they were.

(M) In neither case did the lecturers attempt any moral justification.

(M) He had been captured by the CPVF on 4th of March after he had parachuted down when his plane was put out of action by AA fire. He was then on a railway-cutting mission. He had flown only one mission with bacteriological containers, and when doing this he felt extremely bad, though obeying the orders of his superior officers. He also felt much more nervous than usual. He wished he could have had the courage to resist the orders. While flying the mission he reflected how horrible it would be if his own family were to be subjected to the artificial dissemination of insidious diseases.

(N) He did not remember ever having seen anything in US air force regulations and general instructions concerning the internationally recognised usages of war, such as the prohibition against shooting prisoners. It was only after he had become a prisoner of war that he first heard of the Geneva Convention against bacteriological warfare.

(O) As to what had decided him to avow his actions and describe his experiences after capture, he wished to insist that he was giving his testimony of his own free will, having been subjected to no pressure, physical or moral. From the beginning he had felt remorse at having participated in bacteriological warfare. Then among the Chinese friends he had undergone a kind of conversion, one of the most difficult phases in his life. Now he wanted to let the whole world know how such a weapon was being used against innocent women and children.

(Z) The reaction of his fellow service-men to what was being done was the same as his own. The other three pilots who were present at the second lecture all showed surprise and abhorrence. In fact there was what might be described as a stunned silence. Particularly they could not imagine how such a terrible weapon could be used when peace talks had already been going on for a long time. They realised that they were not supposed to discuss bacteriological warfare, even among themselves. One could generally tell when a pilot had been flying a bacteriological warfare mission because he was gloomy and depressed, and could probably be found trying to forget it in the bar.

(M) The reason why so long a time had elapsed between his capture and his statements was that while he had been captured on the 4th March, he did not get to the base camp until April 20th, and his interrogation did not begin until the end of May. After that, in constant conversation with his Chinese guide, it was not long before what he had done became more than his conscience could stand, and thus he made his declaration on the 18th June.

(N) How was it that his feelings had come to change? Well, first of all there was the sincerity and real kindness of the Chinese Volunteers. They had nothing but good treatment for him, and he suffered no privations which it was in their power to relieve. Moving through the country, he came to appreciate the honest and simple country people of Korea, wanting only to build a better life in their own way. Yet everywhere he saw towns and villages razed to the ground, and people weeping over fresh graves. He saw schools and school buses burned out with napalm. He saw dreadful things being done to the transport system; he himself was

wounded when the road on which he was travelling north was raided, and the truck in front was blown to pieces with many Chinese and Koreans in it. Indeed, he and other prisoners felt ashamed at the way in which the Chinese supply service drivers nightly risked their lives to bring supplies to the P.O.W. camps. During the "interrogation", which took rather the form of long discussions and mutual explanations, he had been shown every possible consideration.

(M) Before joining the Air Force he had taken a B.Sc. in Chemistry at Citadel College, Charleston, S.C., and after that had been a teaching assistant at Tulane University, New Orleans, where he took his M.Sc. in Physical Chemistry in June, 1950.

(A) At Charleston he had been a member of the ROTC, and got a commission there. He was called to active service in Aug. 1950.

(N) In the second lecture encephalitis was not mentioned, only typhoid, cholera, plague, etc.

There was nothing in either of the lectures about self-destroying containers, but there was mention of infected leaflets and papers.

(M) In the second lecture emphasis was laid on two types of containers (a) air-bursting VT fuse bombs which were suitable for bacterial emulsions or the like and not suitable for insects, and (b) parachute types which were suitable for insects infected with bacteria. He thought he remembered that radar devices were sometimes substituted for VT fuses. In any case the important thing was to explode the bomb at a predetermined height above the ground so that its contents might be distributed over the most suitable area.

For example he released his own bacterial bombs at 7,000 ft.; they dropped 5,000 ft. before exploding and opening. For this purpose there was no need to reduce speed, the bombs were let go at 350 m.p.h. Other bombs were set to explode and open at only 50-100 ft. above the ground.

(A) He was not in a position to say where the biological material was being fabricated. At Luke Base he was told that the bacteriological containers have to be delivered fresh each week or two. From Maryland (Camp Detrick) to Korea need take only two days' flying across the Pacific. But he also believed that extensive facilities remained over in Japan

from the last war, and it was likely that they were being put to use.

(O) Yes, he had heard, probably in one or other of the lectures, of the possibility of delivering mice and rodents by means of parachute containers. No mention was made about clams.

(Z) Of course they had had many inoculations; the regular things, such as tetanus, typhoid, cholera, smallpox, etc. Capt. McLaughlin had said that they were well protected against anything likely to be used in bacteriological warfare.

(P) Whether insect or bacteria containers and bomb-refills were kept at 0°C. he did not know. At his own airfield they were certainly kept in an underground shelter, but when he was there the weather was extremely cold. Quite possibly in hot weather refrigeration might be needed.

(M) In spite of the fact that the questioner was not satisfied by his account of the method of acclimatising insects and bacteria to cold, he could only say that he was reporting what Major Williams had said. According to his understanding, bacteria were subjected to low temperatures until nearly all had died, and then subcultured, so that gradually the most cold-resistant strains would be selected. Insect vectors were crossed with other races of the same species coming from cold climates, so as to produce races more resistant to cold but still capable of carrying the disease-producing bacillus or other agent.

(N) He did not know anything about either leaflet bombs or the thick cardboard flare-type parachute container. He would not have been likely to have heard much about parachute-borne containers, since these were not suitable for distribution from fighter-bombers.

(A) On the single bacteriological mission which he himself had flown, he had carried two bombs which were different from ordinary 500 lb. bombs only by a colour—they were bright olive-green, the explosive ones being old and faded since they were stock left over from the last world war.

He did not examine them because he didn't want to, though there was no guard there who might have stopped him. He just checked that the protective wires had been removed from the fuses, so that the bombs were armed. They looked like ordinary 500 lb. ones.

(P) No, he had never seen anyone filling bacteriological bombs, or putting bacterial cultures or insects into spraying tanks.

(O) On a bacteriological mission, the pilots were instructed that if it was impossible either to return to base or to make a forced landing on South Korean territory or to drop the containers anywhere north of the front line, they should bail out and let the aircraft crash and burn, so as to destroy the evidence.

Concluding Remarks:

The witness said that he was very glad to have an opportunity of making a statement before an International Commission which he, for his part, regarded as the highest court concerned with war or peace at the present time. It was essential that the American people must know the facts. Blinded by their newspapers and radio commentators, the American people had no conception of what the war in Korea was like, nor of the fact that bacteriological warfare was being used against the population of Korea and Northeast China. He felt deeply distressed that it was not in his power to inform every man, woman and child in the United States of the truth. They were indeed a good people, but their present government was not a good government. The Commission must somehow see to it that the knowledge of the facts was brought to the attention of everyone in the world. The American people would then rise up against the employment of this wicked weapon, and repudiate those who had ordered it.

He himself had started on the path of scientific research, and now he felt honoured to be in the presence of distinguished scientists from many countries. He thought that they must feel very bad about those American scientists who today were giving all their talents to devising ever new ways of sowing disease and death. Members of the Commission had his great respect at having come to Korea not without risk to themselves to find out the truth, now armed with his testimony and that of others, they surely should not fail to publish the truth abroad in the world. Here he wished to make a special appeal to the British and Brazilian members of the Commission, whose peoples had the closest connection with his own people, and he implored them to leave nothing undone to

bring the facts home to the men and women of the United States. It was necessary that the members of the Commission should not for a moment relent, otherwise things would come about it in the future, even worse than anything which had yet been done. He often felt particularly distressed when he thought of the son whom he hoped one day to have, though as yet he was not married. He did not see how he could hope to gain his respect by telling him that he had served his country in Korea by spreading infectious diseases among an innocent peasant people, who asked only to improve their existence in their own way. He sometimes asked himself whether he was a new type of criminal which modern society had brought into being. When the full realisation came to him of what he had done, he could hardly bear it. He called only for peace so that every people could have a chance to raise their children in quietness and content.

[The Commission's Chairman for the day then shook hands with Lt. O'Neal, thanking him warmly on behalf of the Commission for his sincere cooperation. He noted that all present had been deeply moved by the concluding declaration of the witness. Lt. O'Neal need have no fear that the Commission would fail to perform its task; it had now gathered a large mass of material, which it had every hope of presenting to the world in such a way that it could not be ignored or brushed aside, even by the most unsympathetic circles. The Chairman said further that he was sure that the members from the UK and from Brazil would remember what Lt. O'Neal had said. He himself had been greatly interested in the remark of the witness about feeling like a new kind of criminal, for all the members of the Commission had certainly devoted thought to the position of a service-man under orders to perform some act of mass slaughter or destruction with the blind indiscriminate weapons existing today. He had never expected to find himself in the position of one pronouncing an absolution, but indeed he thought that Lt. O'Neal had already gained it himself by his action in coming forward to denounce those who lay such fearful responsibility on young men subject to military discipline. Such methods of war must be protested against time after time. Lastly, members of the Commission sympathised with Lt. O'Neal in that his scientific career had been cut short, and hoped that when peace soon returned to East Asia, he would be able to return home and renew his scientific work, in which he might well make valuable chemical discoveries to enrich the life of man and to benefit peaceful humanity.]

4) *Lt. Paul Kniss* (aet. 25) of Monmouth, Illinois.

Lt. Kniss' opening statement was substantially identical with the written document ISCK/5, here reproduced as App. NN. He described the three secret lectures which he attended, the first by Capt. Laurie at Craig Base in June, 1951, the second by Capt. Holleman at Camp Stoneman near San Francisco towards the end of Feb. 1952, and the third at an advanced base in Korea, by Capt. McLaughlin, on 21st March, 1952. The first of these lecturers was non-committal, the second stated definitely that though the United States possessed means of bacteriological warfare it was not using them in Korea, and asked the pilots to deny any such stories; while the third stated as a fact that bacteriological warfare methods had been in full use there since 1st Jan. 1952. After the last of these lectures the pilots had to sign a statement that they understand that they would be liable to punishment under a certain Article of War if they ever revealed the information which had been given to them on this matter.

Capt. McLaughlin made it clear that the US Government intended to deny all allegations of the use of bacterial warfare as long as possible. The pilots were given to understand that the whole matter was in the category of "Top Secret" and that they were never to speak about it even among themselves and never to touch the bombs which they would find loaded on to their planes. Lt. Kniss was shot down on his 27th mission. According to his remembrance, at the third lecture there was mention of the delivery by parachute-borne container of rats, mice, lice and fleas, infected with various diseases.

Responses to questions followed.

(M) Yes, he was quite willing to tell of his civil life background. His father was a farm-hand. When he had been a boy the family had lived in the country and in small towns such as Keithsburg, Ill. He quit high school after 1½ years, his family not having been able to afford clothes for him sufficiently good to enable him to mix with the other boys and girls. In 1944 he enlisted in the Navy, and served therein 2 years.

(M) Few of his fellow-pilots were of upper middle-class origin, nearly all were workers and draftees, and all without excep-

tion were completely disgusted at the job which they were called upon to do. In spite of the prohibition on talking, a certain amount of discussion, especially in the bar, could not be avoided, and it was thus that he knew of the bacteriological missions which had been carried out by Lt. Daleo and Col. Crow. The witness knew that everyone was disgusted because the feeling amounted to what might be called mass discontent. The pilots drank a lot, indeed excessively.

Usually when drinking they were gay, but in these days they became more and more glum, and fist-fights in the officer club were frequent, a thing which he had never seen anywhere else.

Thus there was a great difference in morale between the Korean war and World War II. The pilots of today were not willing to make any sacrifice; they did not in fact believe in their cause, and were anxious only to complete their 100 missions and return to the USA. He himself had often broken off attacks when AA fire was fairly strong, though in the last war it would not have shaken his resolution and he would have pressed the attack home. The Korean war was as different from World War II as night from day. There was no eagerness, no exaltation, no belief in a sacred cause or a just war.

As time went on, in fact, the service-men he knew were coming to believe more and more that it was an unjust war, and it was the methods they were forced to employ on the civilian population which led them most strongly to this conclusion. They were fed up with napalm bombing and saturation bombing. They hated to have to release napalm on Korean civilian habitations which they knew were not military targets. When one pilot came back saying that he had destroyed a schoolhouse with napalm the other pilots were extremely sarcastic at his expense. Again, there was the unnecessary killing of civilians, including women and children, by strafing of roads and villages. Orders were given regarding this with utter disregard for any sense of decency. He personally had seen and heard pilots reprimanded at the showing of the films automatically taken when the guns of their planes were fired, for not having strafed civilian settlements enough, and having spared Korean families who could have been killed.

Above all what made the pilots bitter was the fact that the Kaesong truce talks were going on all the time. They could not see why it was necessary to continue indiscriminate slaughter.

(N) No, there was no United Nations mystique among the airmen. They had heard the official line of argument, but they were not convinced that the moral position of the United States was sound. They were rendered doubtful, however, mainly because of the things they were continually ordered to do, and which they greatly resented doing. Moreover, they were irritated by the daily news releases, which systematically distorted the facts. Raids which destroyed mud huts and killed Korean peasants working near by were regularly reported as the destruction of North Korean military barracks. Bombing of railway lines was reported just as such, with never a mention of the destruction brought to the people living alongside the tracks. Attacks on the civil population were of course never admitted. On the whole, the airmen felt that the news releases were absolutely lying and false.

(O) No, he was not afraid of any reprisals against his family, or of "reception camps" in which he might be placed when he returned to the U.S.A. He had full faith in the American people that they would support him and back him up. If not, then he was prepared to face whatever the future might bring, for had he not made his present statements he could never have had peace of mind, and there were some duties which overrode all others.

(O) All pilots were fully inoculated.

(N) No, he had never heard anything about paper parachute-borne containers which destroyed themselves by fire after delivering their cargo. He remembered that Capt. McLaughlin had said that the Americans wanted the Korean people to think that the epidemics from which they might suffer arose directly and naturally out of war conditions, such as the failure of normal water supplies.

No, he had never heard of anything like the "egg-shell" containers described by the questioner. In general the pilots were rather afraid of discussing such things much among themselves.

(O) As for checking, i.e. the "arming" of the bombs, pilots were told not to shake bacteriological bombs. All aircrafts were steam-sterilised after return.

(A) Where the containers were loaded with the biological material he could not say. The flight from San Francisco to Japan would take 36 hours at most. But there might well be biological warfare factories in Japan. For instance, the Tachikawa Base was one of the largest air-bases he had ever seen—no less than 15 miles long. Bacterial warfare factories might well be located there.

Concluding Remarks:

The witness said that he desired to make a few final statements. In the past he himself had fought Nazi-Fascism, and in that war he had lost a brother. To his mind, the utilisation of bacteriological warfare was an action about as bad as anything that the Nazi-Fascists had ever done. Now was the time to stop it before it went any further. To this end he hoped his small quota of evidence would contribute, and that it might lead to a world at peace. He hoped that his sons might have the chance to grow up in such a world.

His fellow-pilots had asked themselves, "how could saving the Korean people from communism, for democracy, imply killing as many of them as possible first?"

In fact, he had come to conclude that this was a war not to save the world but to grab the world. Once again he wished to thank the Commission for their labours, and beg them to spare no effort to tell the facts to the world.

[The Commission's Chairman for the day then shook hands with Lt. Kniss, thanking him for his sincere cooperation. He expressed the hope, on behalf of the Commission, that peace would soon come to East Asia, and that the witness would then be able to return to his country, where he wished him every success and if possible a chance to have that higher education which circumstances had formerly denied him, but for which he seemed eminently fitted.]

APPENDIX PP

Memorandum on the Public Health and Hygiene Movement in New China

I

Immediately upon its arrival in Peking, the Commission was able to make two observations:

(1) The great cleanliness and order in the streets, and in parks, yards and shops.

(2) The almost complete absence of mosquitoes and flies.

Peking is still to a large extent an old-fashioned city with a great number of small, old, houses and yards. All courtyards seen were found to be well swept every day, and there was never any garbage lying about. Even in the junk-yards all timber or pieces of scrap-iron were seen to be collected in tidy heaps. Those members of the Commission who had previous experience of life in China as recently as six or seven years ago were unable to conceal their amazement at the changes affected.

The Commission found that foodstuffs for sale are now always covered. Tea is served in the streets in cups with lids from covered containers. In the parks there are covered flasks for hot water. All spittoons are surmounted by wooden discs which fit over them and carry wooden sticks convenient for handling without bending down. A corresponding device is used to cover latrines. Moreover, the habit of spitting, formerly so widespread, has greatly decreased. Fly-swatters are at hand for use if a fly should appear, and may be seen wielded with great vigour and effect by small boys in every country village. Everyone without exception has become "fly-conscious".

II

Members of the Commission met with Prof. Yen Ching-ch'ing, Director of the Health Department of the City of Peking, and Professor of Public Health at Peking University Medical College, who made the following statements. Before 1949 the hygienic standard in the country was very low. The liberation, however, brought about a complete change in the attitude of the people towards hygiene as an important factor in

promoting good work. The cadres* have emphasised this point everywhere very strongly. This is the background of what follows:

(1) *Garbage.* Peking was formerly a city full of garbage. The streets were dirty. There was one district, called "Two-Dragon Road" which was popularly named in summer "Two-Dragon River", and in winter "Two-Dragon Mountain", because there was so much garbage. Already in 1949 the old garbage dumps (dating back some 40 years) were removed. Now there is equilibrium between production and removal of garbage. In 1950, 500,000 cu. m. were removed, in 1951, 700,000 cu. m.; the increase being due to increase in living standards (perhaps also population?). All garbage cans are now covered.

(2) *Latrines.* Before the liberation, latrines were as a rule uncovered, now all are covered (see above). They are emptied every day in covered containers. Some houses still have no latrines, and people from them go to the public ones which are kept scrupulously clean. Many new public ones have been built in every city.

Both private and public latrines are kept lined with lime. Even now only about 1% of the population of Peking has access to water closets. The night soil is spread out on fields some distance outside the city and is so turned over that no flies can develop in it. Composted manure is made from it.

(3) *Drains.* Peking has had rain-water drain since the Ming period (16th century), but they had not been repaired for a long time and did not function properly. After liberation they were restored and new ones were laid down, for instance in "Two-Dragon Road", which is now a road all the year round. At one point in Peking an open drain-well where people could and did fall in, was closed; this was the famous "Dragon's Beard Drain" about which a play has been written. At certain points outside the city there are septic tanks where the sewage sediment is separated out and disposed of.

(4) *Water supply.* Formerly only 1/3 of the population had running water, and the remainder had to get their water from pumps or wells. Now, after liberation, running water is available for the entire population within the city.

(5) *Flies and Mosquitoes.* Already in 1949 the necessity of a campaign against mosquitoes was felt and this campaign has been going on ever since. The closing of all open drains has been an important measure in this. Another equally important item has been the closing of all holes in trees: these are sealed with a mixture of clay and lime, thus prevent-

* A technical term used in modern China for trained government executives.

ing them from becoming breeding places for mosquitoes after rain. One can see these sealed places on trees everywhere.

The most important measure taken against the flies seems to be the covering up and the daily emptying of the latrines. Dr. Yen said: "If you take good care of the latrines, close the drains and remove the garbage, there will be no flies".

(6) *Dogs.* From the spring of 1952 dogs were forbidden in Peking. The Commission saw not a single dog during the first month of its stay in China. The reasons for forbidding dogs were: (a) dogs may carry infection; (b) dogs' excrement lies about and may attract flies; (c) dogs are a possible reservoir-host for the virus of encephalitis; (d) dogs create traffic difficulties.

(7) *The Health Campaign.* This measure is probably the most important of all in the fight against flies and mosquitoes. The remarkable results reached in China in this respect, and concerning public health in general, can be explained only by the whole-hearted cooperation of all and everybody. It seems that in this way unbelievable results are reached with very simple means. The slogan of the health campaign is: "Everybody needs Health" and "To Protect the Health of the People is the People's Duty".

The health campaign against flies and mosquitoes goes on every year from March to the autumn. Meetings are held, sometimes big ones with the government official as a speaker, then smaller meetings for different groups of people in different parts of the city. Contests are arranged. The health authorities make regular inspections. Organisations (women, youth) guarantee that all decisions shall be carried out 100%. Usually there is one person responsible for 10 houses or families. There has been a great change on the psychological level; formerly mutual criticism of neighbours would have been contrary to age-old custom, but now criticism, if constructive, and self-criticism, is greatly encouraged. Interest has grown every year. And this year the results are better than ever.

The health campaign is carried on not only through meetings but in many different ways. There are a number of attractive coloured posters showing how to clean your house or your clothes, how to handle children, etc. There is a flow of radio instruction. Newspapers carry articles all the time on health and on the importance of health measures. Entertaining illustrated booklets are sold at a very low price. In shows and concerts it often happens that a celebrated young star, or two together, a man and a woman, sing about how good it is to keep healthy, and what one ought to do; these performances are evidently very popular to judge from the applause.

(8) *Health Statistics.* As a result of the above-mentioned measures infectious diseases are already much less prevalent than before. Thus if the number of deaths from typhoid in Peking April-June, 1950 is expressed as 100 the corresponding figure for the same period 1951 is 40. For dysentery there was an unexplained rise in 1951 (100 to 114) but the figure for 1952 is 51. For other intestinal infections (Summer diarrhea, helminths, etc.) the corresponding figures are for 1951, 74 and for 1952, 35.

In this connection it must also be mentioned that while not more than 7.3 million people per annum (highest figure 1946) were vaccinated against smallpox during the Kuomintang period, more than half of the population (307 million) have been vaccinated since the Liberation to the end of 1951. This figure has now increased to 369,360,893 at the end of June 1952. Already smallpox epidemics have almost disappeared. Since 1949 there has been no case of cholera in China. The re-education of midwives has already led to a diminished death rate for the newly born (Tetanus neonatorum); in Peking, 1949, 0.72%; 1950, 0.57%; 1951, 0 25% (live birth). Maternal mortality has been nearly halved; 0.24% in 1950, 0.13% in 1951 (Peking). In order to diminish the possibilities for plague epidemics there has been a regular war against rats in Northeast China; during 1951, 35 million rats were killed.

(9) *Vaccine Production.* The Commission visited the National Vaccine and Serum Institute; directed by Dr. Tang Fei-Fan.

The institution, responsible to the Ministry of Health, was built in 1946-47 but has now been very much enlarged. It has seven branches in different cities of China but this is the headquarters. The total personnel is 700-800, of whom about 500 are technical. The Institute has its own farm outside Peking and its own glass factory. Scientific standards are of the highest order. The main work of the Institute is the production of vaccines. Production of smallpox vaccine is of course enormous. Besides conventional vaccine lymph, they also produce dried vaccine in ampules.

Other vaccines made on a large scale are those for typhoid, paratyphoid, cholera, plague, pertussis and typhus (egg method).

The BCG-vaccine is made in a special separate building, as also are those for tetanus and gas-gangrene.

Encephalitis vaccine (against Chinese aestivo-autumnal encephalitis) is made using the brains of white mice.

All vaccines pass finally through the Central Institute for Standardisation of Biological Products (under the Ministry of Health) so that control is thus very severe.

The Institute has also a large production of sera, but makes penicillin and streptomycin so far only on a small scale.

(10) *Insecticide Production.* Although the insect eradication campaigns do not rely primarily on chemical methods, the production of DDT and other insecticides has soared in the new China, and this has proved helpful and important both for the defence against bacteriological warfare and for the needs of the Chinese People's Volunteer Forces.

III

The Commission subsequently had the opportunity of seeing how some of the health work and the struggle against the bacterial warfare danger is carried out in Northeast China.

This was encountered already at the railway station in Peking. If one had a ticket for any place north of Shanhaikuan one had to show one's vaccination card (with photo), before entering the train. This is the place where the train passes through the Great Wall.

The trains themselves are very clean. Posters (coloured and attractive) telling about how to promote health and fight against the bacterial warfare danger are much in evidence on the trains.

Tea for all passengers is served on the train in covered glass containers. At some of the stations there are rows of women selling foodstuffs. They are dressed in white, wear a face mask, sell the food from covered containers and serve it with tongs (steamed bread, broiled chicken, sausages, etc). They are private sellers under the control of the railway authorities.

When returning to Peking from Shenyang (Mukden) the Commission had to leave the train for some time at the border station of Shanhaikuan while the train was disinfected. Since bacterial warfare started, a new method of disinfecting trains has been invented and put into operation. It consists of a short tunnel in the walls of which are a number of tubes, through which cars can be sprayed either with steam at 200°C or—if this would hurt the cargo—with a disinfectant. Passenger coaches are disinfected in the ordinary way by spraying from containers worked by hand.

IV

In Shenyang (Mukden), the Commission noted the same things as in Peking: cleanliness, no garbage, almost no flies and mosquitoes.

Dr. Pai Hsi-ch'ing, Vice-Minister of Health, People's Government of Northeast China gave information to the Commission concerning measures taken against the dangers of bacterial warfare. He said that they had been

convinced that bacteriological war was being waged against the Northeast China since February, 1952. A great educational work has been done. The whole population has been organised and knows how to act. They have also been taught personal hygiene and how to keep their homes clean. They know that everything dropped from planes or from the sky should at once be destroyed and that one must not touch it with one's hands. They know that all rat-holes must be sealed up. When it is certain or likely that an attack has been made disinfection is immediately carried out. (For detailed orders concerning this see App. M., Document M-1). Ever since the beginning of the surmised bacteriological warfare the population has been told to try to kill insects (flies, mosquitoes, fleas, etc.). Searches for insects are carried out regularly, depending on the condition of the warfare. School children and young people have been especially active.

In Shenyang, the Commission saw a soyabean mill with a modern hygienic cover. This mill is of a kind that has been in use in China for at least a thousand years. It consists of two millstones with bores in them so as to let in the soya beans at the top and let out the ground material at the bottom. Water is added slowly to ease the grinding. There is an appliance so that the mill can be worked by a donkey. Formerly dust, dirt and hairs from the donkey and consequently bacteria would contaminate the material to such an extent that it could not be prepared during the hot season. A very adequate wooden cover for the old mill has now been invented and is in use everywhere. There is even a mirror so arranged that one can see when the vessel is beginning to fill up.

In Shenyang some members of the Commission visited the houses of ordinary workers. The general sweeping is done at 5 o'clock in the morning. After the sweeping is finished vegetables and fruit for the day are brought home. In a corner of the yard of one of the houses visited there was a high and narrow earthenware jug, probably very old, covered by a wooden disk. We heard that this was the vessel for disinfection of vegetables and fruit. They were treated for 5 minutes with a solution of calcium-hypochlorite.* Thereafter fruit was washed in boiled water and vegetables cooked, the latter are rarely eaten raw in China but they are often cooked for a very short time.

It is on the whole very characteristic of China and very impressive that all health measures are achieved without altering the old and often quite primitive living conditions. There was no time to wait for the day when new houses could be built, houses with modern facilities. So they

* Chlorinated lime.

just went ahead and taught people to live hygienically under their old fectly, at any rate in China today.

V

When the Commission travelled by truck some 150 km. between La-Ha and Kan-Nan in the far north of Heilungchiang Province on the border of Inner Mongolia there was again reason to marvel at the cleanliness and order everywhere. White washed covered wooden garbage boxes were standing outside every house in the villages. There were very clean primitive earth closets, well covered. Ditches were well maintained, and rat-holes were not seen. In many places one could see the very popular black-boards put up at village cross-roads where rules and warnings and news were written in chalk, often with talented drawings of dangerous insects and bacteria. This kind of poster is cheap, has local colour and can be changed with great ease.

The Commission saw many examples of the fact that the population of Northeast China knows how to act when confronted with bacteriological warfare. There is no hope of causing a panic amongst them. The Commission was convinced of this both from its own experience in the remote hsien of Kan-Nan and from the behavior and the words of all the eye-witnesses who gave evidence before it. Its members talked with people from Liao-tung Province near the Korean border and with many more men, women and children, from the neighbourhood of Shenyang (Mukden). As one listened to all these people one began to see something previously unknown—a terrible, strange and touching epic unfolding itself in front of one's eyes. One could see hundreds, indeed thousands, of people with improvised masks, hand-protections, and chopstick tweezers made of cornstalks in their hands, move slowly day after day over their own countryside stooping to collect small insects and feathers one by one. And being aware, while thus patiently working, that death was close at hand. It is known that some of them felt fear—they said so—but nobody complained.

They could forget fear in their eagerness to do their duty, to follow the rational instructions given by the government, to destroy everything thrown down upon them, to collect insects, feathers and rodents, to seek containers—in other words, they were, and are, both willing and determined to serve the people.

VI

The International Scientific Commission, having observed the health measures and health education of Peking and Northeast China subscribed unreservedly to the following statements:

(1) There is in China today a vast movement towards personal and social hygiene which is supported whole-heartedly by 500 million people. A health movement on this scale is hitherto unknown in the history of man.

(2) This movement has already helped to bring about a greatly diminished mortality and morbidity from infectious diseases.

(3) It seems to us that it would be not only criminal but also futile to try to exterminate such a people by bacteriological warfare.

Fig. 1. Learning how to catch rats.

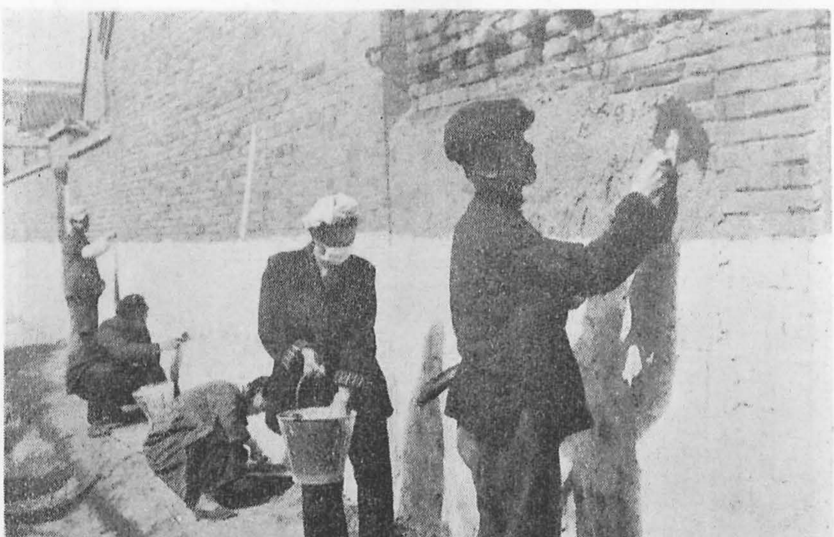


Fig. 2. Sealing the rat holes and crevices on the walls.

Fig. 3. Women organised into insect-catching teams to exterminate the insects dropped on the snowy ground by the American planes.

Fig. 4. Incineration and burial of the insects dropped from the American planes.

Fig. 5. Local populace burning large quantities of insects dropped by the American planes.

Fig. 6. Team of health workers.

Fig. 7. Insecticides.

Fig. 8. Health workers spraying disinfectants in regions where American planes had dropped insects.

Fig. 9. Preventive inoculations being given by health workers.

Fig. 10. Scientists studying diseases caused by the insects dropped from the American planes.

APPENDIX QQ

Report on the Occurrence of Epizootics of Septicaemia among Fowls Following the Dissemination by U.S. Military Planes of Spiders Carrying *Pasteurella multocida*

(ISCC/12)

I. Introduction

From various arthropods disseminated by American airplanes, there have been isolated not only pathogens which are hazardous to man, but also those which cause serious epizootics in domestic animals and fowls. In those areas where the American airplanes had intruded and dropped insects, not only men were taken ill and died, but disease and death were found to occur among domestic fowls. The details concerning the occurrence of epizootics of septicaemia among fowls following the dissemination of spiders carrying *Pasteurella multocida* by American airplanes are given below:

II. The Wolf-spiders dropped from American Airplanes Proved by Experiments as Carriers of Pasteurella multocida

1

On February 29, 1952, Chao Kuang-hsin and other inhabitants of Lao-kuan Village of Ta-ku District, Pen-hsi, heard the American planes passing over their village. On March 4th when they went to exterminate insects outside the village, they discovered large quantities of spiders and flies along the west river side of the village. They were scattered over an area of about one square kilometer. There might be as many as over twenty insects per square meter. It was very cold on that day, the river was still frozen, and the ground was still covered by snow. Some of the spiders and flies were found crawling on the snow. According to the local residents, who had often collected fire wood along the river side, such a phenomenon had never been seen before.

These spiders have been identified by Wang Feng-chen, a specialist on Araneida and Lu Pao-ling, an entomologist, to be wolf-spiders, *Tarentula* sp. (Doc. QQ-1)

Bacteriological examinations were performed by bacteriologists Chu Chi-ming and Ching Kuan-hua on these spiders. The procedures and results are as follows (Doc. QQ-2):

The spiders were ground with 5 ml. of sterile physiological saline into a suspension. When cultured on plain agar plate, small, round and grayish white colonies with translucent edges were obtained. Microscopic examination revealed Gram negative, bipolar staining short bacilli. They were non-motile. Pure culture was then made from these colonies for further studies.

The suspension was also inoculated intraperitoneally into white mice which died next day. Same short bacilli were found in the visceral organs. The spleen was ground and inoculated intraperitoneally into another mouse which also died within 72 hours. The liver and spleen of the latter mouse were again made into a suspension which was injected intraperitoneally into a guinea-pig, 2 ml. being used. The guinea-pig died in two days. Bipolar staining short bacilli were found in the liver and spleen smears of these dead animals, and from these organs cultures identical in characteristics to those obtained directly from the spiders were also isolated. The characteristics of the pure culture are: no haemolysis; fermentation of glucose, sucrose and mannitol with production of acid but no gas; no fermentation of lactose; positive indol reaction; no liquefaction of gelatin; no change of litmus milk; no growth in bile; negative methyl red reaction.

A 24 hour culture was then made into a suspension, containing 0.5 mg/ml. The suspension was injected under the skin of a duck, a chicken, a pigeon, a guinea-pig and a rabbit, each receiving 1 ml. In addition, 0.5 ml. was injected subcutaneously into each of two white mice. All the inoculated animals died within 24 - 48 hours. Bipolar staining short bacilli were found in the heart blood and visceral organs of these dead animals. According to these results it was concluded that *Pasteurella multocida* were isolated from the wolf spiders.

2

At 3:46 p.m. on March 2nd, 1952, four American airplanes intruded into the air of Antung City, circling around till they escaped at 3:50 p.m. At 7:30 a.m. on the next day, Wang Yu-sheng, an officer of the Health Department of Liaotung Military Headquarters, while

strolling in Chen-chiang-shan Park of the city, discovered a large quantity of spiders on the snow on the road and down the slope north of a wrestling ground. Immediately he reported this to the District Chief, Yang Chung-hsin, who went to examine the situation himself and found that the area covered by the disseminated spiders was about 5,000 square meters; each square meter sometimes contained as many as over twenty spiders. These have also been identified to be *Tarentula* sp. (Doc. QQ-3).

On March 6th, Sun Ching-chang, a physician of the Health Department of the city administration, received the specimens of these spiders which he ground into a suspension and cultured on blood agar plates. After 24 hours incubation, there appeared non-haemolytic dew-drop like colonies. Microscopic examination revealed numerous Gram negative, bipolar staining short bacilli (Doc. QQ-4).

The biochemical properties and the results of pathogenicity tests were similar to those of the bacteria isolated from the spiders found at Pen-hsi.

0.5 ml. of a bacterial suspension was injected under the abdominal skin of a duck. It died 11 hours thereafter. On autopsy, the heart showed hemorrhage and was dark red in color; liver was congested and enlarged; spleen congested and dark in color. Microscopic examination and culture of heart blood revealed similar organisms with same cultural characteristics.

Conclusion: *Pasteurella multocida* isolated from the wolf-spiders.

III. The Sudden Occurrence of Septicemia in Fowls in Areas Where American Airplanes Have Invaded and Dropped Insects and Spiders

1

After 10 a.m. on March 6th, 1952, Li Fang-t'ien, a resident of No. 193 of Group 31, Hsing-lung Street, Chin-t'ang District, Antung City, personally saw an American airplane flying over the city from the northeast toward southeast. After the air raid alarm was over, he discovered numerous spiders in his backyard. He thought that the occurrence of spiders in such a cold weather was very strange and that they might have been dropped by the American airplane. While he collected and exterminated these spiders, his three ducks were also in the yard, looking for foods.

In the morning of March 8th, one of Li Fang-t'ien's ducks died and in the same afternoon the other two also died. Thinking that

the death of his ducks might be due to their feeding on the spiders, he sent these ducks to the Health Bureau for examination.

In the very evening autopsy of these ducks was performed in the laboratory of the Health Bureau. Dark blood clots were found in the auricles; the liver, spleen and kidneys were enlarged and congested. Dr. Sun Ching-chang isolated *Pasteurella multocida* from the visceral organs of these ducks (Doc. QQ-5).

The isolated culture was re-examined and confirmed by bacteriologists Chu Chi-ming and Chao Ch'eng-lin to be *Pasteurella multocida* (Doc. QQ-6).

2

In the morning of March 21st, 1952, while the residents of Chinchow City were fishing out the spiders and flies dropped by the American airplane and coming down from the upper stream of Nu-erh River, they noted that the ducks of the Poultry Breeding Station of the Agricultural Bureau of the People's Government of Liao-hsi Province were feeding on these spiders and insects on the river.

Next morning, two dead ducks were found in the Poultry Breeding Station. Later, dead ducks were found successively and by the end of April a total of sixty three ducks have died. Between the end of April and May 7th, there were still a few ducks showing dyspnoea and much decreased activity, which recovered only after the injection of anti-hemorrhagic septicemia serum.

At autopsy, the liver and spleen of these ducks were enlarged and intestines hemorrhagic. Cultures from the visceral organs of these dead ducks, as performed by bacteriologists Chu Chi-ming and Chao Ch'eng-lin, yielded *Pasteurella multocida* (Doc. QQ-7).

IV. Discussion

1

Under natural conditions, wolf spiders are dormant in winter. They should not be discovered on the surface of snow and at a temperature below zero degree Centigrade. But immediately after the invasion of Antung City by the American airplanes, they were found on the snow-covered ground in the City.

At Pen-hsi, the highest temperature on March 4th was -2°C and the lowest was -19.6°C, the average was -9.9°C. However, following

the invasion by the American airplane over Lao-kuan Village of that City, a large number of spiders were found on the snow, covering an area of about one square kilometer. The conditions under which the wolf-spiders were discovered clearly indicate that their appearance was definitely not a natural but an anomalous phenomenon and that they were dropped by American airplanes.

2

Among bacteria-laden arthropods disseminated by American airplanes, we have been able to isolate repeatedly pathogenic organisms from the wolf-spiders. For instance, the wolf spiders disseminated by the American airplanes near by Lou-ho-t'ao of K'uan-tien were found to carry *Bacillus anthracis.* (The wolf-spiders dropped by American airplane at Tsingtao were also found to carry *Bacillus anthracis.*) At Antung and Pen-hsi the wolf spiders were found carrying *Pasteurella multocida.* All these bacteria-carrying wolf spiders belong to the same genus. This further indicates that they were dropped by American airplanes.

3

The fact that *Pasteurella multocida* was isolated from the wolf spiders is not just an accident. Rosebury and Kabat, in discussing the use of *Pasteurella multocida* as a bacteriological weapon, said, "This organism is capable of producing severe epidemic disease in animals, with a mortality of 70-100 per cent and death in a few hours to a few days. The organism is easily cultivated, and although its resistance is generally low, it is likely that means could be devised for its maintenance to meet the needs of bacterial warfare." The ducks of the Poultry Breeding Station at Chin-chow developed fowl septicaemia soon after feeding on the spiders dropped by American airplanes. The same fate happened to the ducks of Mr. Li Fang-t'ien at Antung City. From the wolf spiders collected from Chen-chiang-shan, Antung City and Lao-Kuan Village of Ta-ku District, Pen-hsi, *Pasteurella multocida* has been isolated. Therefore, we conclude that the sudden death of the ducks is due to eating wolf spiders carrying *Pasteurella multocida,* which were dropped by American airplanes.

Reference:

1. Rosebury, T. and Kabat, E. A.: Bacterial Warfare. J. Immunol. 56:7-96, May, 1947.

DOCUMENT QQ-1

REPORT ON ENTOMOLOGICAL IDENTIFICATION

Serial No. of Specimen	Original No. 46	Date Received: March 16, 1952

Circumstances of Discovery:

On Feb. 29, 1952, an American airplane invaded Pen-hsi City and on March 4, a large number of spiders, flies and other insects were discovered on the snow covered ground along the west river side of Lao-Kuan Village, Ta-ku District of that City. The temperature on that day was: highest —2°C and lowest —19.6°C.

Results of Identification:

Scientific Name: **Tarentula** sp. (**Araneida, Lycosidae**)

Common Name: Wolf spider

Comment: Wolf spider should not be discovered on the snow-covered ground and at a temperature below zero degree Centigrade. This kind of spiders discovered in the above-mentioned place was undoubtedly disseminated by the American airplane.

Remarks:

Identified by:

Wang Feng-chen, Sc.D., Professor, Tientsin Army Medical College.
Lu Pao-ling, B.A. in Agriculture, M.S., Assistant Professor, Department of Entomology, Peking College of Agriculture.

Date Reported: May 4, 1952.

DOCUMENT QQ-2

REPORT ON BACTERIOLOGICAL EXAMINATION

1. Number of Specimen: 46.
2. Source of Specimen: Pen-hsi.
3. Date Received: March 8, 1952.
4. Name of Specimen: 3 Spiders.
5. Procedure: The specimen was ground with 5 ml. of sterile normal saline to make a suspension which was used to inoculate into white mice and for culture.

   (1) On the plain agar plate streaked with the suspension, small round grayish white colonies with elevated central part and translucent edges were seen. Microscopic examination of the Giemsa stained smears revealed bipolar staining short bacilli. These bacilli were Gram negative and non-motile. Pure culture was then made.

   (2) 0.5 ml. of the above suspension was injected into the peritoneal cavity of each of the two white mice. Both died next day. Examination of the Giemsa stained smear of the heart blood and spleen of the dead mice revealed bipolar staining bacilli. Gram stain: negative. The spleen of the animal was ground to form a suspension which was inoculated intraperitoneally into another white mouse. The animal died on the third day after inoculation. The liver and spleen of the dead animal were again made into a suspension, 2.0 ml. of which were used to inoculate into the peritoneal cavity of a guinea-pig. The guinea-pig died in 2 days. In the smears of the liver and spleen of these dead animals, bipolar staining short bacilli were seen. Cultures of the liver and spleen yielded bacilli having the same characteristics as those obtained from the spiders.

6. Pure Culture Examination:

   (1) Morphology: Bipolar staining short bacilli. Gram negative. No spore formation. Non-motile.

   (2) Cultural characteristics: On the plain agar plate, after incubation at 37°C for 24 hours, small round grayish white transparent colonies were seen, with elevated central part, glistening and smooth surface and regular edge. After being cultured for 2-3 days, the colonies grew bigger. The central part

became translucent and appeared grayish white with a yellowish tint. The outer edge was still transparent. No hemolysis on the blood agar plate.

(3) Biochemical properties: This organism fermented glucose, sucrose and mannitol with production of acid but no gas. It did not ferment lactose. Indol reaction positive. No liquefaction of gelatin. Litmus milk showed no change. No growth in bile. Methyl red reaction negative.

(4) Pathogenicity Test: The isolated culture was incubated for 24 hours and it was then made into a suspension, containing 0.5 mg/ml. The suspension was then injected subcutaneously into a duck, a chicken, a pigeon, a guinea-pig and a rabbit, each receiving 1 ml. In addition, 0.5 ml. of the suspension was injected subcutaneously into two white mice. All these animals died within 24 - 48 hours after inoculation. Bipolar staining short bacilli were found and isolated from the heart blood, spleen and liver of all these animals.

7. Conclusion: *Pasteurella multocida* isolated from the spiders.

Examined by: Ching Kuan-hua, M.B., Assistant Professor of Bacteriology, National Medical College, Shenyang.

Confirmed by: Chu Chi-ming, M.B., Ph.D., Chief Technical Expert of National Vaccine and Serum Institute, Peking.

Date reported: April 28, 1952.

DOCUMENT QQ-3

REPORT ON ENTOMOLOGICAL IDENTIFICATION

Serial No. of Specimen	Original No. 38004	Date Received: March 18, 1952

Circumstances of Discovery:

An American plane invaded Antung in the afternoon of March 2, 1952. Next morning a great number of spiders were discovered on the snow in the Chen-chiang-shan Park of the city.

Results of Identification:

Scientific name: **Tarentula sp. (Araneida, Lycosidae).**

Common Name: Wolf spider

Comment: Wolf spiders should not be discovered on the surface of snow and at a temperature below zero degree. These spiders discovered in the above-mentioned place undoubtedly were disseminated from the American plane.

Remarks:

Identified by:

Wang Feng-chen, Sc.D., Professor, Tientsin Army Medical College.
Lu Pao-ling, B.A. in Agriculture, M.S., Assistant Professor, Department of Entomology, Peking College of Agriculture.

Date Reported: May 4, 1952.

DOCUMENT QQ-4

REPORT ON BACTERIOLOGICAL EXAMINATION

Specimen number: 11.

Name of Epecimen: Spiders.

Source of specimen: Chen-chiang-shan, Antung city.

Date Received: March 6th, 1952.

Procedure:

1. Culture: On March 8th, five of the spiders were ground with physiological saline into a suspension which was cultured on blood agar plates. After incubation for 24 hours, colorless, translucent and dew-like colonies appeared. Microscopical examination revealed numerous bipolar staining, Gram negative small bacilli.

2. Biochemical characteristics: fermented glucose, mannitol and sucrose, producing acid but not gas; did not ferment lactose and maltose; no growth in bile; no motility in semisolid; produced indol; no hemolysis.

3. Animal experiment: 0.3 ml. of the 24 hour meat broth culture was inoculated subcutaneously into a white mouse. The mouse died in 48 hours. On microscopical examination and by culture of the heart blood, bacteria with morphology and characteristics similar to those of the organisms obtained from the direct culture were found.

   0.5 ml. of bacterial suspension was inoculated subcutaneously into a duck. The duck died in 11 hours. On autopsy, heart showed hemorrhage, and was dark red in color; liver was congested and enlarged; spleen congested and dark purple in color. Microscopical examination and culture of heart blood gave same results as above.

Conclusion: *Pasteurella multocida* isolated from the spiders.

Examined by Sun Ching-Ch'ang, Physician, Laboratory of Health Bureau, Antung.

Date Reported. March 25th, 1952.

DOCUMENT QQ-5

REPORT ON BACTERIOLOGICAL EXAMINATION

Specimen number: Zoo-2.
Name of specimen: Duck.
Source of Specimen: Sent by Li Fang-t'ien, number 193, 31st group, Hsing-lung street, Antung City.
Date Received: March 8th, 1952.

Procedure:

Autopsy findings: Dark blood clots were found in the auricles. Petechiae were seen on the viscera. Liver was congested, enlarged and dark purplish red in colour. Spleen and kidneys congested and enlarged.

Microscopical examination: Gram-negative, bipolar staining small bacilli.

Culture: Heart blood, liver and spleen of the dead duck were cultured on blood agar plates, and after 24 hours, many small, round dew-like colonies appeared. Microscopical examination of smears showed bipolar staining, Gram negative small bacilli.

Animal experiment: 0.2 ml. of the 24 hour meat broth culture was inoculated subcutaneously into a mouse. The mouse died 48 hours later. On autopsy, the heart, liver and spleen were found to be enlarged with petechiae. When these organs were cultured, small, round dew-like colonies were seen on the culture plate. Microscopic examination of smears revealed Gram-negative bipolar staining small bacilli.

0.3 ml. of the 24 hour meat broth culture was inoculated subcutaneously into a domestic duck. The duck died in 24 hours. Culture and microscopical examination gave similar results as before.

0.5 ml. of the 24 hours meat broth culture was inoculated subcutaneously into a guinea-pig. The guinea-pig died in 12 hours. Results of culture and microscopical examination yielded similar results.

Conclusion: The organism isolated from the domestic duck was tentatively identified as *Pasteurella multocida.*

Examined by Sun Ching Ch'ang, Physician, Laboratory of Health Bureau, Antung.

Date of Report: March 22nd, 1952.

DOCUMENT QQ-6

REPORT ON BACTERIOLOGICAL IDENTIFICATION

1. Number of Specimen: 38025.
2. Source of Specimen: Antung.
3. Date Received: April 3, 1952.
4. Kind of Specimen: A strain of bacteria isolated from domestic duck. Original No. Zoo-2.
5. Procedure: Isolated colonies on the blood agar plate were selected and subcultured on plain agar slants. Microscopic examination of the stained smear revealed Gram-negative bacilli which showed bipolar staining when stained with methylene blue. The white mice and pigeon inoculated died in 36 and 48 hours respectively.

   (1) Morphology: Gram-negative. Small bacilli with bipolar staining when stained with methylene blue. Non-motile.

   (2) Cultural Characteristics:
   - a) Plain agar: Grayish white, small and round translucent colonies with smooth surface and entire edge.
   - b) Blood agar: Round and slightly elevated colonies, showing no hemolysis.

   (3) Biochemical properties:
   - a) Indol reaction—positive.
   - b) Gelatin—no liquefaction.
   - c) Semisolid medium—no motility.
   - d) Bile—no growth.
   - e) Milk—no change.
   - f) Fermentation tests—Fermented glucose, mannitol and sucrose with production of acid but no gas.

6. Conclusion: *Pasteurella multocida.*

   Examined by Chao Ch'eng-lin, M.B., Assistant Professor in Microbiology, Harbin Medical College.

   Reported by Chu Chi-ming, M.B., Ph.D., Chief Technical Expert, National Vaccine and Serum Institute, Peking.

7. Date Reported: April 19, 1952.

DOCUMENT QQ-7

REPORT ON BACTERIOLOGICAL EXAMINATION

1. Specimen number: 20055.
2. Source of specimen: Chin-chow.
3. Date Received: March 27th, 1952.
4. Name of specimen: Dead duck.
5. Procedure:

At autopsy the liver and spleen of the duck were found to be enlarged and intestines hemorrhagic. Microscopical examination of stained smears showed Gram-negative small bacilli. Methylene blue stained smear showed bipolar staining. Culture of liver and spleen on plain agar medium grew translucent grayish white small colonies. Microscopical examination of the stained smear showed the same type of bacilli as those in the direct smear. Animal experiment consisted of injecting 0.4 ml. of bacterial suspension subcutaneously into a white mouse. The mouse died after 20 hours. On the smears and cultures made from the organs of this white mouse, similar organisms were found.

6. Examination of pure culture:

(1) Morphology: Gram-negative. Methylene blue stained smear showed bipolar staining small bacilli.

(2) Cultural characteristics:

a) Plain agar culture: Incubated at 37°C for 24 hours grew round, grayish white translucent small colonies with even edge and smooth surface.

b) Blood agar culture: Grew round, slightly flat, non-haemolytic colonies.

(3) Biochemical characteristics:

a) Indol reaction positive.

b) Gelatin not liquefied.

c) No motility in semisolid.

d) No growth in bile.

e) No change of litmus milk.

f) Produced acid but no gas in glucose, mannitol and sucrose.

(4) Pathogenicity test:

a) Mouse: 0.4 ml. of bacterial suspension was injected subcutaneously into a mouse about 15-20 grams in weight. Died in 20 hours.

b) Pigeon: 0.5 ml. of bacterial suspension was injected subcutaneously. Died in 14 hours.

c) Rabbit: 0.4 ml. of bacterial suspension was injected subcutaneously into a rabbit of 1,000 grams. Died after 18 hours.

d) Guinea pig: 0.3 ml. of bacterial suspension was injected subcutaneously into a 300 gram guinea-pig. Died after 48 hours.

7. Conclusion: *Pasteurella multocida* was isolated.

Examined by: Chao Ch'eng-lin, M.B., Assistant Professor in Microbiology, Harbin Medical College.

Reported by: Chu Chi-ming, M.B., Ph.D., Chief Technical Expert, National Vaccine and Serum Institute, Peking.

Date of Report: April 19, 1952.

APPENDIX RR

Declaration by Dr. Franco Graziosi

Having participated between the 10th and the 31st August, 1952, in Peking, in all the meetings of the International Scientific Commission for the Investigation of the Facts concerning Bacteriological Warfare in Korea and China, I wish to make the following statements.

I was warmly welcomed by the Commission as Observer-Consultant, and I have had accesss to all documents prepared by the Commission or submitted to it by the Chinese and Korean authorities. From its members I had further information and clarification both during the sessions and privately. I was able also, by the kindness of the Chinese authorities, to make use of the rich library of the China Union Medical College.

During this period I have had the opportunity of making the personal acquaintance of many Chinese scientists and of discussing with them many of the technical aspects of the questions involved. The relations which I have had the honour to entertain with them have given me the highest regard for their scientific culture, their humanism, and their moral integrity.

On the ground of these experiences, and fully aware of the grave responsibility with which the work of the International Scientific Commission is invested, I wish to express my concurrence with the conclusions of its Report in stating that the peoples of Korea and China have been the objective of bacteriological weapons and that these weapons have been employed by units of U.S.A. armed forces. I feel myself all the more able to make this declaration because, in my capacity as bacteriologist, I have been able to convince myself that the work of my Chinese colleagues is irreproachable.

I believe that I am interpreting correctly the thought of all microbiologists throughout the world when I express the hope that a science with such noble traditions will not be applied to warlike ends. Offence should not be given to the memory of those who dedicated, and sometimes sacrificed,, their lives in the struggle against disease and human suffering.

(Signed) Franco Graziosi.

APPENDIX SS

Excerpt from Medical Literature Presented as a Reference Concerning the Use of Exploding Projectiles for the Dissemination of Pathogenic Organisms

Rochaix, A.

"Epidémies provoquées à propos de la guerre bactérienne." Revue d'Hygiène, **58**, 161-180. 1936.

Page 174.

A second method which might be employed by the aggressor would be the use of exploding projectiles (shells, bullets, etc.). Is it feasible? Would the germs be able to withstand the very high temperaturc liberated, the pressure exerted, the shock wave, and the action of toxic gases?

Without the need of analysing the mode of action of each of these factors (1), we shall only state here the opinion of Trillat, the expert best qualified on the subject: "The shock by explosion does not destroy the germs, however violent it may be. On the contrary, it helps the splitting up of microbial masses. The liberation of heat and of gases of combustion being instantaneous, will not last sufficiently long enough to exert their lethal action on the microbes. These facts are absolutely well established." (2).

(1) Klein: La guerre microbienne, Thèse. Lyon, Dec. 1935.

(2) A. Trillat: On bacterial weapons. Comptes rendus XVIII Congrès d'Hygiène. Paris, Oct. 1931, page 124.

APPENDIX TT

Biographical Register of Chinese and Korean Scientists and Medical Men

CHANG CHIEH-FAN

Field of work:
  Epidemiology.
Present position:
  Vice-Director, Institute of Plague Prevention Northeast China.
Scientific training:
  M.B., Medical College of Manchuria, Shenyang (1936).
  Postgraduate study, Department of Medicine, Army Medical School, Tokyo, Japan (1938).
Positions previously held:
  Station Chief, Western Manchurian Plague Prevention Service.
Publications:
  Report on plague prevention work.

CHANG CHIH-SAN

Field of work:
  Spectroscopy.
Present position:
  Assistant Research Member, Institute of Applied Physics, Academia Sinica.
Scientific training:
  B.S., South Western Union University (1943).
Positions previously held:
  Research Assistant, Institute of Physics, National Academy of Peiping.
Publications:
  5 papers on atomic spectrum, molecular spectrum and spectroscopic chemical analysis.

CHANG HSUEH-TEH

Field of work:
  Internal medicine, infectious diseases.
Present position:
  Assistant Professor of Medicine, China Union Medical College, Peking.

Scientific training:

M.D., Peking Union Medical College (University of the State of New York) (1941).

M.Sc., University of Illinois, Chicago, U.S.A.

Positions previously held:

Chief Physician, First Municipal Hospital, Tientsin.

Publications:

12 papers on viral diseases and others.

CHANG NAI-CHU

Field of work:

Internal medicine and bacteriology.

Present position:

Assistant Professor of Bacteriology, China Union Medical College, Peking.

Scientific training:

M.D., Peking Union Medical College (University of the State of New York) (1940).

Research Fellow of the George William Hooper Foundation, University of California, U.S.A. (1948-1949).

Positions previously held:

Physician, Chung Ho Hospital, Peking (1942-1948).

Publications:

15 papers on bacteriology.

CHANG WUN-YUNG

Field of work:

Pathology.

Present position:

Pathologist, Central Sanitary and Epidemic Prevention Station, Korea.

Positions previously held:

Assistant Professor of Pathology, Seoul University, Seoul, Korea.

Scientific training:

Doctor of Medicine (Taigu).

CHANG YU-CH'ANG

Field of work:

Chemistry.

Present position:

Director of Chemical Laboratory, Institute of Science, Ministry of Industries, People's Government of Northeast China.

Positions previously held:
Professor of Chemistry, Changchun University.

Publications:
Several papers on electrical chemistry, advanced organic chemistry, etc.

CHAO CHEN-SHENG

Field of work:
Parasitology.

Present position:
Assistant Professor of Parasitology, Peking University Medical College.

Scientific training:
B. Sc. (Biology), Fu-Jen University, Peking.
Research Fellow, Department of Parasitology, Peking Union Medical College.
Research Fellow, Department of Parasitology, University of California, U.S.A.

Publications:
3 papers on parasitology.

CHAO CH'ENG-LIN

Field of work:
Bacteriology.

Present position:
Assistant Professor of Microbiology, Harbin Medical College.

Scientific training:
M. B., Army Medical School, Harbin (1939).

Positions previously held:
Technical Expert and Vice-Director, Anti-epidemic Center, Harbin (1946-1950).

CHAO CHUNG-YAO

Field of work:
Radioactivity and nuclear physics.

Present position:
Research Member, Institute of Modern Physics, Academia Sinica.

Scientific training:
B.S., South Eastern University, Nanking (1925).
Ph.D., California Institute of Technology, U.S.A. (1930).

Positions previously held:
Professor of Physics, Tsing Hua University (1932-1946).
Professor of Physics, Nanking Central University (1946-1950).

Publications:

About 20 papers on radioactivity and nuclear physics.

CHEN, SICIEN H. (CHEN SHIH-HSIANG)

Field of work:

Entomology.

Present position:

Director, Laboratory of Entomology, Academia Sinica.

Scientific training:

B.Sc., Fuhtan University, Shanghai (1928).
Doctor of Paris University, France (1934).
Research worker, Musée Nationale d'histoire Naturelle, Paris.
Research worker, British Museum of Natural History.
Research worker, Deutsches Entomologishes Institut, Berlin-Dahlem.

Positions previously held:

Research Fellow, Institute of Zoology, Academia Sinica, (1934-1950).

Publications:

77 papers on entomology.

CHEN WEN-KWEI

Field of work:

Bacteriology (plague expert).

Present position:

President, Chinese Medical Association, South West China Branch.

Scientific training:

M.D., West China Union University.

Positions previously held:

League of Nations Health Officer for Plague Studies in India, 1936.
Assistant Technical Expert, National Health Administration, Nanking.
Head, Dept. of Laboratory Medicine, Emergency Medical Training School, Kweiyang.

Publications:

Report on plague epidemic in Changteh, 1941, and other papers.

CHENG KENG

Field of work:

Veterinary bacteriology.

Present position:

Professor of Bacteriology, Department of Veterinary Medicine, College of Agriculture, National Nanking University.

Scientific training:

B.S.A., University of Nanking (1924).

Sc.D., University of Michigan, U.S.A. (1934).

Positions previously held:

Assistant, Lecturer, and Head of the Division of Bacteriology, Agricultural College, University of Nanking (1924-1930).

Senior Technical Expert, National Agricultural Research Bureau (1935-1939).

Professor and Head, Department of Veterinary Medicine, National Kwangsi University (1939-1947).

Director, Bureau of Agriculture and Forestry, and concurrently Director of Agricultural Experimental Station, Fukien Province (1947-1948).

Professor of Veterinary Bacteriology, National Central University, Nanking (1948-1949).

Publications:

8 papers on veterinary bacteriology.

CH'ENG SHAO-CHIUNG

Field of work:

Veterinary medicine.

Present position:

Director of the Department of Animal Husbandry, Ministry of Agriculture.

Scientific training:

V.M.D. Iowa State University, U.S.A. (1926).

D.P.H. Johns Hopkins University, U.S.A. (1930).

CHEO CHIA-CHIH

Field of work:

Plant pathology.

Present position:

Professor and Head of the Department of Plant Pathology, Peking College of Agriculture.

Scientific training:

B.S., University of Nanking (1932).

Research Fellow in Plant Virology, University of Cambridge (1946-1948).

Positions previously held:

Instructor in Plant Pathology, Tsing Hua University (1934-1943).

Assistant Professor of Biology, Yunnan University (1943-1946).

Assistant Professor of Plant Pathology, Tsing Hua University, College of Agriculture (1949).

Publications:

6 papers on plant pathology.

CHI SHU-LI

Field of work:

Bacteriology (Plague expert).

Present position:

Chief of Divisions of Bacteriology and Zoology, Institute of Plague Prevention, Northeast China.

Scientific training:

M.B., Harbin Medical College (1943).

Positions previously held:

Assistant Chief, Mobile Epidemic Prevention Corps, Ministry of Health, Northeast China (1948).

Publications:

4 papers on plague.

CHI SU-HUA

Field of work:

Surgery.

Present position:

Secretary, Chinese Medical Association.

Assistant Professor of Surgery, Shantung Medical College, Tsinan.

Scientific training:

M.B., Shanghai Medical College (1941).

Positions previously held:

Assistant Resident Surgeon (1942-1946) and Resident Surgeon (1947) Shanghai Medical College.

Resident Surgeon, Billing's Hospital, University of Chicago, U.S.A. (1947-1949).

Publications:

8 papers on surgery and medical education.

CHIEN SUNG-SHU

Field of work:

Taxonomy of flowering plant.

Present position: Director, Institute of Systematic Botany, Academia Sinica.

Scientific Training:

B.Sc., Illinois University, U.S.A. 1914.

Positions previously held:

Prof. of Biology, Southeastern University, 1926-1930.

Head, Dept. of Botany, Biological Laboratory, Science Society of China, Nanking, 1930-1949.

Publications:

20 papers on systematic botany, ecology and plant physiology.

CHIN YAO-TING

Field of work:
Parasitology.

Present position:
Head of Department of Biology, National Medical College, Shenyang.

Scientific training:
B.S., Cheloo University, Tsinan (1914).

Positions previously held:
Assistant Lecturer, Assistant Professor and Professor of Biology, Cheeloo University, Tsinan (1914-1928).
Research Fellow, Yenching University, Peking (1928-1930).
Professor of Biology, Mukden Medical College, Shenyang, (1930-1948).

Publications:
6 papers on parasitology.

CHING KUAN-HUA

Field of work:
Bacteriology.

Present position:
Assistant Professor and Acting Head, Department of Bacteriology, National Medical College, Shenyang.

Scientific training:
M.B., Medical College of Manchuria (1942).

Positions previously held:
Assistant Professor of Bacteriology, Shenyang Medical College.

Publications:
7 papers on bacteriology.

CHIU WEI-FAN

Field of work:
Plant pathology.

Present Position:
Assistant Professor of Plant Pathology, Peking College of Agriculture.

Scientific training:
B.Sc., College of Agriculture, University of Nanking (1935)
Ph.D., University of Wisconsin, U.S.A. (1947).

Positions previously held:
Assistant Professor, Tsing Hua University College of Agriculture.

Publications:
14 papers on phytopathology and mycology.

CHOI HYUN-SOO

Field of work:

Infectious diseases.

Present position:

Chief, Korean Mobile Anti-Epidemic Corps.

Scientific training:

M.D., Seoul Medical College, Seoul, Korea.

CHONG HI-WON

Field of work:

Pathology.

Present position:

Pathologist, Central Sanitary and Epidemic Prevention Station, Korea.

CHOU CHIEN-JEN

Field of work:

Zoology.

Present position:

Executive Member and Vice-President, All-China Association for the Dissemination of Science and Technology.

Position previously held:

Lecturer of Biology, University of Shanghai.

Professor of Biology, Chinan University, Shanghai.

Professor of Biology, Auhui University.

CHU CHI-MING

Field of work:

Bacteriology.

Present position:

Chief Technical Expert, National Vaccine and Serum Institute, Peking.

Scientific training:

M.B., Shanghai Medical College.

Ph.D., University of Cambridge.

Positions previously held:

Assistant, Department of Public Health, Shanghai Medical College (1939).

Technical Expert, National Epidemic Prevention Bureau (1940-1945).

Publications:

16 papers on bacteriology, virology, and immunology.

CHU FENG-CHUN

Field of work:
Pathology.

Present position:
Professor of Pathology, National Medical College, Shenyang.

Scientific training:
M.B., Medical College of Manchuria, Shenyang, (1940).

Positions previously held:
Professor, Chinchow Medical School (1944-1947).
Assistant Professor of Shenyang Medical College, (1947-1948).

Publications:
2 papers.

CHU HUNG-FU

Field of work:
Entomology.

Present position:
Vice-Director, Laboratory of Entomology, Academia Sinica.

Scientific training:
B. S., Tsing Hua University, Peking.
M. S., Ph. D., University of Illinois, U.S.A.

Positions previously held:
Visiting Professor of Zoology, Iowa Wesleyan College, U.S.A.

Publications:
19 papers on entomology.

CHU TAN

Field of work:
Epidemiology.

Present position:
Lecturer, Department of Public Health, Peking University Medical College.

Scientific training:
M. B., Peiping University Medical College, (1937).

Positions previously held:
Professor of Microbiology, Kuangsi Provincial Medical College (1945-1948).

CHUNG HUEI-LAN

Field of work:
Internal medicine, Tropical diseases.

Present positions:
Director and Chief of Medical Service, Central People's Hospital, Peking.
Clinical Professor of Medicine of China Union Medical College, and of Peking University Medical College.

Scientific training:
Graduated from Peking Union Medical College, M.D., University of the State of New York (1929).
D.T.M., London School of Tropical Medicine and Hygiene.
Research Fellow, Tropeninstitut, Hamburg, Germany.

Positions previously held:
Resident Physician, Associate, Associate Professor, Peking Union Medical College, (1929-1942).
Director and Chief of Medical Service, Central Hospital, Peking.

Publications: 99 papers on medicine, tropical diseases and parasitology.

FANG KANG

Field of work:
Bacteriology.

Present position:
Assistant Research Member, Department of Microbiology, Central Research Institute of Health, Peking.

Scientific training:
B. S., Tsing Hua University (1937).
Research Fellow in Bacteriology, Peking Union Medical College (1937-1939).
Research Fellow in Plague, Haffkin Institute, Bombay, India (1942-1943).
Research Fellow in Bacteriology, Harvard Medical School, U.S.A. (1948).

Positions previously held:
Technical Assistant, Central Epidemic Prevention Bureau, Kunming (1939-1940).
Assistant, Kweiyang Public Health Personnel Training Institute (1940-1941).
Lecturer, Army Medical School, Anshun (1941-1943).

Publications:
2 papers on immunology.

FANG SHIH-SHAN

Field of work:

Epidemiology.

Present position:

Secretary General, Chinese Medical Association.

Scientific training:

M. B., Chiba University, Japan.

Positions previously held:

Professor, Army Medical College, Tientsin (1910-1912).

Surgeon-General, Ministry of War, Peking (1912-1917).

Director, Shou Shan Hospital, Peking (1916-1940).

Director, Central Epidemic Prevention Bureau, Peking (1924-1926).

Head of the Department of Public Health, Peiping University Medical College (1933).

Secretary, Peking Anti-tuberculosis Association, (1946-1951).

Publications:

7 papers on bubonic plague, health administration, medical history and health texts.

FENG LAN-CHOU

Field of work:

Parasitology.

Present position:

Professor and Head of the Department of Parasitology, China Union Medical College.

Scientific training:

M. D., Cheeloo University, Tsinan (1929).

D.T.M., D.T.H., Liverpool School of Tropical Medicine and Hygiene (1933-1934).

Positions previously held:

Assistant, Associate, Assistant Professor, Peking Union Medical College (1929-1942).

Professor and Head of the Department of Parasitology, Peking University Medical College (1942-1947).

Publications:

76 papers on parasitology.

FENG LAN-PIN

Field of work:

Tropical diseases.

Present Position:

Leaturer on Tropical Diseases, National Medical College, Shenyang.

Scientific training:
M. B., Shanghai Medical College.
Positions previously held:
Assistant in Pathology, Kuei Yang Medical College (1937-1940).
Research Assistant, Rockefeller Institute for Malaria Research, Yunnan (1940-1943).
Resident Physician, Central People's Hospital, Peking (1949-1951).
Publications:
2 papers on malaria study.

HO CHENG

Field of work:
Physician.
Present position:
Honorary President, Chinese Medical Association.

HO CHI

Field of work:
Medical entomology.
Present Position:
Professor of Medical Entomology, Dairen Medical College.
Scientific training:
B. S., Yenching University, Peking.
Ph. D., University of Liverpool, (England).
Positions previously held:
Technical expert, Fan Memorial Institute of Biology, Peking.
Research Member, National Institute of Health, Nanking.
Publications:
18 papers on entomology.

HO ZAH-WEI

Field of work:
Nuclear physics and ballistics.
Present position:
Research Member, Institute of Modern Physics, Academia Sinica.
Scientific training:
B. S., Tsing Hua University (1936).
Dr. Eng. Berlin (1940).
Positions previously held:
Physicist, Siemens Laboratory Germany (1940-42).
Research worker at K. W. Institute, Heidelberg; and Laboratoire de Chimie nucleaire du College de France (Paris). (1942-1948).

Research Member, Institute of Atomic Physics of National Academy of Peiping (1948-1950).

Publications:

14 papers on nuclear physics and 1 paper on ballistics.

HSIA WU-P'ING

Field of work:

Mammalogy and Hydrobiology.

Present position:

Research Assistant, Academia Sinica.

Scientific training:

B. S., Yenching University (1945).

Position previously held:

Research Assistant of the National Academy of Peiping (Peking) (1945-1949).

Publications:

4 papers on hydrobiology.

HSIEH SHAO-WEN (Samuel H. Zia)

Field of work:

Bacteriology.

Present position:

Professor, Department of Bacteriology, China Union Medical College.

Scientific training:

M.D., Hunan-Yale Medical College, Changsha (1926).

Research fellow, Department of Bacteriology, Harvard Medical School (1932-34).

Positions previously held:

Resident, Assistant and Associate, Department of Medicine, Peking Union Medical College (1926-33).

Lecturer, Associate Professor (1933-42), Professor and Head of the Department of Bacteriology (1947-51), Peking Union Medical College.

Physician, Tientsin Women's Hospital (1942-45).

Technical Expert, Central Epidemic Prevention Bureau, Peking (1945-47).

Publications:

39 papers on microbiology and immunology.

HSIN CHUN

Field of work:

Bacteriology.

Present position:

Chief Technical Expert, Northeast Epidemic Prevention Institute.

Scientific training:

M. D., Nagoya Imperial University, Japan (1945).

Positions previously held:

Assistant professor of Bacteriology, (1936-41), Professor of Bacteriology, Harbin Medical College (1942-44).

Research work at the Department of Bacteriology, Nagoya Imperial University (1941-42).

Chief Technical Expert, N. E. Biological Products Institute, (1945-48).

Publications:

9 papers on virology, etc.

HSU YING-K'UEI

Field of work:

Neurology, psychiatry, neuro-pathology.

Present position:

Associate Professor, Department of Neurology and Psychiatory, China Union Medical College.

Scientific training:

M. D., Peking Union Medical College—University of the State of New York (1934).

Pastgraduate study, Hirnpathologisches Institut der Deutschen Forschungsanstalt für Psychiatrie, München, Germany (1938-1939).

Postgraduate study, Division of Neurology and Neurosurgery, the University of Chicago Clinics, Chicago, Illinois, U.S.A. (1939).

Previous positions held:

Assistant Resident, Assistant professor, Peking Union Medical College (1934-42).

Professor, Department of Neurology, Peking University Medical College (1942-51).

Publications:

10 papers on neuropathology, neurology and psychiatry.

HU CHENG-HSIANG

Field of work:

Pathology.

Present Position:

Professor of Pathology, China Union Medical College.

Scientific Training:

M. D., Harvard Medical School, 1921.

Positions Previously Held:

Professor of Pathology, Peking University Medical College 1942-46.

Publications:

(1) Text Book of Pathology (1952).

(2) About 50 papers on kala-azar, tumors, white blood cells, etc.

HU HSIEN-HSU

Field of work:

Systematic botany.

Present position:

Research Member, Institute of Systematic Botany, Academia Sinica.

Scientific Training:

B. S., University of California (1916).

M. Sc., Harvard University (1924).

Ph. D., Harvard University (1925).

Positions previously held:

Professor of Botany, Southeastern University.

Director, Fan Memorial Institute of Biology.

Research Member, Institute of Systematic Botany, Academia Sinica.

Publications:

45 papers on systematic botany.

HU CHING-FU (Chengfu F. Wu)

Field of work:

Biology.

Present position:

Concurrent Professor, Department of Zoology, Yenching University.

Scientific training:

B. Sc., (1917), M. Sc., (1919), Soochow University, Ph. D., Cornell University (1922), M. B., Hsiang Ya Medical College, Changsha (1946).

Positions previously held:

Professor, Department of Biology, Soochow University (1923-26).

Professor, Department of Biology, Yenching University (1926-49).

Publications:

72 papers on entomology and invertebrate zoology.

HU HSIANG-PI

Field of work:

Veterinary medicine.

Present Position:

Director, N. E. Research Institute for Veterinary Medicine, Harbin.

Scientific training:

B Agr., Central University, Nanking.

M.R.C.V.S. University of Edinburg England.

Position previously held:

Professor of Veterinary Medicine, Northwestern University, Lanchow.

HUANG CHEN-HSIANG

Field of work:

Virology.

Present position:

Head of Department of Microbiology, Central Research Institute of Health.

Scientific training:

M. D., Peking Union Medical College—University of the State of New York (1934).

Positions previously held:

Assistant Resident and Assistant, Peking Union Medical College (1934-41).

Research Fellow, Rockefeller Institute of Medical Research (1941-42).

Lecturer, Department of Medicine, Columbia University (1942-43).

Director, Division of Experimental Medicine, National Institute of Health (1943-47).

Director, Peking Branch, National Institute of Health (1947-49).

Publications:

39 papers on encephalitis, virus, diphtheria, etc.

HUANG HO

Field of work:

Plant pathology.

Present Position:

Research Assistant, Academia Sinica.

Scientific Training:

B.S., Peking College of Agriculture (1950).

KIM HO-KYOUM

Field of work:

Epidemiologist.

Present position:

Chief, Epidemic Prevention Corps, Korea.

Scientific training:

Doctor of Medicine.

KIM IN-WAN

Field of work:
Entomology.
Present position:
Entomologist, Central Sanitary and Epidemic Prevention Station, Korea.

KIM RAK-ZE

Field of work:
Bacteriology.
Present position:
Bacteriologist, Central Sanitary and Epidemic Prevention Station, Korea.
Scientific training:
M.D. (Taigu).

KUANG KO-ZEN

Field of work:
Systematic botany.
Present position: Assistant research member, Institute of Systematic Botany, Academia Sinica.
Scientific Training:
B.Sc., Hokkaido Imperial University, Japan 1937.
Publications: 2 articles.

KUNG NAI-CH'UAN

Field of work:
Surgery.
Present position:
Director, Shanghai Medical College.
Scientific training:
M.B., Ch.B., Mukden Medical College, 1934.
Publications:
Over 40 articles on war surgery.

KUO AI-JAN

Field of work:
Medicine.
Present position:
Assistant Professor of Medicine, National Medical College, Shenyang.
Scientific training:
M.B., Shanghai Medical College 1941.

Positions previously held:

1. Assistant, Lecturer, Department of Medicine, Shanghai Medical College, (1941-1945).
2. Concurrently Resident, Visiting Physician, Central Hospital Chungking (1941-1945).
3. Head, Dept. of Medicine, Jen-Chi Hospital, Chungking. (1945-1947).

KUO SHU-TIEN

Field of work:
Entomotaxy.
Present position:
Technician in Entomol. Dept., Peking College of Agriculture.
Scientific training:
Graduate, Technical School of Agriculture.
Position previously held:
Technician, Department of Entomology, Tsinghua University.

LI CHI-LUEN

Field of work:
Plant pathology.
Present position:
Assistant, Dept. of Plant Pathology, Peking College of Agriculture.
Scientific training:
B.Sc., Central University Nanking (1948).

LI PEI-LIN

Field of work:
Pathology.
Present position:
Professor and Head of Department of Pathology, National Medical College, Shenyang.
Scientific Training:
M.B., Ch.B., Mukdken Medical College, Shengyang (1927).
Ph.D., London University (1939).
Positions previously held:
Assistant, Peking Union Medical College, Peking (1929-1932).
Assistant Professor, Hsiang-Ya Medical College, Changsha (1932-1936)
Professor, Central University Medical College, Chengtu.
Professor, Chung Cheng Medical College, 1940-1941.
Professor, Northwest Medical College, Sian 1944-1948.
Professor, Central University Medical College, Nanking 1948-1949.
Publications:
Six papers on pathology and anatomy.

LIAO CHENG-CHIH

Present Position:

Chairman, All China Federation of Democratic Youth.
Member of the World Peace Council.

Academic Training:

Waseda University, Japan.
Hamburg University, Germany.

LIN CHEN-KANG

Field of work:

Pathology.

Present Position: Professor and Head of Department of Pathology, Peking University Medical College.

Scientific Training:

M.B., Peiping University Medical College.
Postgraduate Student, Berlin University and Freiburg i/B. University.

Positions previously held: Assistant, Professor of Pathology, Peiping University Medical College (1922-1940).

Professor of Pathology: Shenyang Medical College and Nanking Central University Medical College (1946-1948).

Publications: Three papers on pathology.

LING YONG

Fields of work:

Systematic botany and mycology.
Systematic botany and Mycology.
Research Botanist, Institute of Systematic Botany, Academia Sinica.

Scientific training:

Ingénieur diplômé, Inst. Agr., Univ. Nancy (1923).
Licencié ès Sciences, Univ. Clermont (1927).
Docteur ès Sciences, Naturelles, Univ. Paris (1930).

Positions previously held:

Professor of Botany, Peiping University, Northwest University, Amoy University (1930-1949).

Research Member, National Academy of Peiping (1946-1948).

Publications: Systematic botany 18 papers. Mycology 5 papers.

LIU CHUNG-LO

Field of work:

Entomology.

Present position:

Director, Institute of Entomological Research; Professor and Head of the Department of Entomology, Peking College of Agriculture.

Research Member (concurrently), Laboratory of Entomology, Institute of Experimental Biology, Academia Sinica.

Scientific training:

B.Sc., Cornell University (1922).

Ph.D., Cornell University (1926).

Positions previously held:

Professor and Head of the Department of Biology, Tsing Hua University (1926-29).

China Foundation Chair in Zoology (1929-34).

Professor and Head of the Division of Entomology, Institute of Agricultural Research, Tsing Hua University (1934-47).

Director, Institute of Entomological Research; Professor and Head of the Department of Entomology, Tsing Hua University (1947-49).

Publications: 30 papers on entomology and biology.

LIU TCHEN NGO

Field of work:

Systematic botany and ecology.

Present position:

Director, Botanical Institute, Northeast College of Agriculture.

Scientific training:

Diplômé de l'Inst. Agr. Univ. Nancy (1923).

Licencié ès Sciences Naturelles, Univ. Clermont (1927).

Docteur ès Sciences Naturelles, Univ. Paris (1928).

Positions previously held:

Director, Institute of Botany, National Academy of Peiping.

Professor, College of Science, Peking University. (1929-1950).

Publications: 30 papers on systematic botany and mycology.

LU PAO-LING

Field of work:

Entomology.

Present position:

Assistant Professor of Entomology, Peking College of Agriculture.

Scientific training:

B.S., Soochow University, Soochow (1938).

M.S., Tsing Hua University (1941).

Positions previously held:

Instructor, Division of Entomology, Institute of Agricultural Research, Tsing Hua University (1941-1944).

Lecturer of Entomology, Peking University, College of Agriculture (1946-1949).

Lecturer of Entomology, Peking College of Agriculture (1949-52).

Publications:

9 papers on entomology.

LU SHIO SHAN

Field of work:

Physics.

Present position:

Acting Director, Institute of Applied Physics, Academia Sinica.

Positions previously held:

Research Member, Institute of Physics, National Academy of Peiping.

Head, Dept. of Physics, Chi-Nan University, Shanghai.

Qualifications:

Ph. D., Manchester University England.

Publications:

15 papers on acoustics, optics and X-ray crystallography.

LU TCHEN-HAN

Present position:

Vice Minister of Health, Democratic People's Republic of Korea.

MA SHIH-CHUN

Field of Work:

Entomology.

Present position:

Assistant Research Member, Institute of Entomology, Academia Sinica.

Scientific training:

B. Agr., Peiping University (1937).

M.S., School of Agriculture, University of Utah.

Ph.D., University of Utah and University of Minnesota.

Research Member of Agricultural Experimental Stations of Utah and Minnesota (U.S.A.) and Rothamsted Experimental Station England.

Positions previously held:
  Graduate student, University of Cambridge.
  Technical Expert, Experimental Station of Agriculture, Ministry of Agriculture.
Publications: 17 papers on entomology.

NAM CHANG-CHOON

Field of work:
  Pathology.
Present position:
  Pathologist, Central Sanitary and Epidemic Prevention Station, Korea.
Scientific training:
  M. D. (Seoul).

PAI HSI-CHING

Field of work:
  Pathology.
Present position:
  Vice Minister of Health, People's Government of Northeast China.
Scientific training:
  M. B., Ch. B., Mukden Medical College, Shenyang (1930).
Positions previously held:
  Associate, Peking Union Medical College, Peking.
  Professor, Mukden Medical College, Shenyang.
Publications:
  Over 10 papers on pathology.

PAO TING-CHENG

Field of work:
  Parasitology.
Present position:
  Entomologist, Epidemic Prevention Technical Unit, Chinese People's Volunteer Forces.
  Assistant professor, Shanghai Medical College.
Scientific training:
  B. Sc., Soochow University, Soochow (1935).

RI PING-NAM

Field of work:
Pediatrics.
Present position:
Minister of Health, Democratic People's Republic of Korea.
Scientific training:
M. D. (Seoul University).
Positions previously held:
Professor of Pediatrics, Seoul University.

RI YU-KYU

Field of work:
Bacteriology.
Present position:
Bacteriologist, Central Sanitary and Epidemic Prevention Station, Korea.

SHEN CHI-I

Field of work:
Plant pathology.
Present position:
Dean, Peking College of Agriculture and concurrently Professor of Plant Pathology.
Scientific training:
B. S., Nanking University (1933).
Ph. D., Imperial College of Science and Technology, University of London.
Positions previously held:
Professor of Biology, Nanking University (1940-1948).
Publications:
5 papers on plant pathology.

SUN HSI-PU

Field of work:
Public health.
Present Position:
Professor of Public Health, National Medical College, Shenyang.
Scientific training:
M. B. Medical College of Manchuria, (1937).

Positions previously held:

Assistant, Division of Public Health, Medical College of Manchuria, Shenyang.

On Technical Staff, Technical Institute of Health, Chang-Ch'un. (1938-1947).

Professor, Shenyang Medical College, (1947-1948).

Publications:

Over 10 papers on toxins.

TAI FAN-LAN

Field of work:

Mycology.

Present position:

Professor in Plant Pathology, Peking College of Agriculture.

Scientific training:

B. S., Cornell University, (1918).
Research work at Columbia University, (1919).
Research Fellow, New York Botanical Garden, U.S.A. (1935).

Positions previously held:

Professor, University of Nanking, Nanking.
Professor, Tsinghua University, Peking.
Director, Institute of Plant Pathology, Peking College of Agriculture.

Publications:

27 papers on plant pathology and mycology.

TANG CHIN

Field of work:

Systematic botany.

Present position:

Research Member, Institute of Systematic Botany, Academia Sinica.

Scientific training:

Peking College of Agriculture (1926).
Visiting Botanist, Royal Botanical Garden, Kew (England, 1935-1938).

Position previously held:

Botanist and Curator of the Herbarium, Fan Memorial Institute of Biology, Peking (1928-1949).

TANG FEI-FAN

Field of work:

Microbiology.

Present position:

Director, National Vaccine and Serum Institute, Peking.

Scientific training:

M. D., Hsiang Ya Medical College, Changsha, (1921).

Research Fellow in Bacteriology, Peking Union Medical College, (1921-1924).

Research Fellow and Assistant, Harvard Medical School, U.S.A., (1924-1927).

Positions previously held:

Professor of Bacteriology, Shanghai Medical College (1927-1931).

Head of the Department of Bacteriology, Lester Institute of Medical Research, Shanghai, (1931-1935).

Visiting Research Fellow, National Institute for Medical Research, Hampstead, London (1935-1937).

Director and Chief Technical Expert, National Epidemic Prevention Bureau, Kunming, 1938-1945.

Publications:

32 papers on bacteriology and immunology.

TENG SHU-CHUEN

Field of work:

Plant pathology and mycology.

Present position:

President and Professor, Shenyang Agricultural College.

Scientific Training:

B. Sc., Cornell University, 1925, M. Sc., 1927.

Positions previously held:

Professor of plant pathology, Ling Nan University (1926-27).

Professor of plant pathology, University of Nanking (1927-28).

Professor of plant pathology, Central University, Nanking (1928-31).

Research member, Academia Sinica (1932-50).

Vice President, Shenyang Agricultural College (1950-52).

Publications: 25 papers on plant pathology and mycology.

TSIEN SAN-TSIANG

Field of work:

Radioactivity and nuclear physics.

Present position:

Director of the Institute of Modern Physics, Academia Sinica.

Scientific training:

B. S., Tsing Hua University, Peking (1936).

D. S., Paris University, Paris (1940).

Positions previously held:

Chargé de Recherches, Maître de Recherches au Centre National de la Recherche Scientifique (France) (1944-1948).

Professor of Physics, Tsing Hua University (1948-51).

Assistant Director of the Bureau of Research Planning, Academia Sinica (1951).

Publications:

31 papers on radioactivity and nuclear physics.

TSUI CHI-CHENG

Field of work:

Bacteriology.

Present position:

Acting Director, Institute of Plague Prevention, Ministry of Health, People's Government of Northeast China.

Scientific training:

M. B., Medical College of Manchuria, (1932).

Post graduate study, Tokyo Army Medical School, Japan (1933).

WANG FA-TSUAN

Field of work:

Systematic botany.

Present position:

Research Member, Institute of Systematic Botany, Academia Sinica.

Scientific training:

Visiting Botanist, Kew Herbarium, Royal Botanical Gardens, Kew, England (1935-38).

Positions previously held:

Research assistant, Research member, Fan Memorial Institute of Biology, Peking (1929-46).

Research Member, Institute of Botany, National Academy of Peiping (1946-1948).

WANG FENG-CHEN

Field of work:

Arachnology.

Present position:

Professor of Histology, Tientsin Army Medical College.

Scientific training:

D. Sc., University of Vienna, Austria.

Position previously held:

Professor of Histology, Tung Chi University Medical College.

Publications:

Six papers on arachnology and histology.

WANG PIN

Field of Work:

Surgery.

Present position:

Minister of Health, People's Government of Northeast China.

WEI HSI

Field of Work:

Bacteriology.

Present position:

Director, Research Institute of Health, Dairen; Professor and Head, Department of Bacteriology, Dairen Medical School.

Scientific training:

M. B., Shanghai Medical College.

Positions previously held:

Resident Physician, Shanghai Red Cross Hospital (1932-33).

Research Member, Lester Institute, Shanghai (1933-37).

Research Fellow, Department of Bacteriology, Harvard Medical School (1937-39).

Technical Expert and Director, Kun-Ming and Kwei-Yang Branch, Laboratory of Central Epidemic Prevention Bureau (1939-47). Professor and Head, Department of Bacteriology, Shanghai Medical College (1947-1949).

Publications:

5 papers on bacteriology.

WEI WEN-PIN

Field of work: Bacteriology.

Present position:

Head, Department of Virology, Research Institute of Health, Dairen.

Assistant Professor, Department of Bacteriology, Dairen Medical School.

Scientific training:

M.B., Hsiang-Ya Medical School (1942).

Certificate, Department Bacteriology and Virology, Pasteur Institute, Paris.

Positions previously held:

Technical Expert, Central Epidemic Prevention Bureau (1942-47).

Technical Assistant, Pasteur Institute, Paris, France (1947-1949)

Publications:

5 papers on bacteriology.

WON HONG-KU

Field of work:

Zoology.

WOO CHIEN-CHANG

Field of work:

X-Ray crystal analysis.

Present position:

Assistant Research Member, Institute of Applied Physics, Academia Sinica.

Scientific training:

B.S.,. Nanking Central University (1933).

Research work in University of Manchester (1948-1950).

Positions previously held:

Research Assistant of the Institute of Physics, Academia Sinica.

Publications: Experimental physics, 4 papers.

WOO DJI-LEE

Present position:

Director-General of Medical Services, Chinese People's Volunteer Forces in Korea.

Scientific training:

M.B., Shanghai Medical College (1937).

WU CHENG-YIH

Field of work:

Systematic botany.

Present Position:

Vice Director, Institute of Systematic Botany, Academia Sinica.

Scientific Training:

B. Sc., Tsing-Hwa University (1937).

Positions previously held:

Assistant, Lecturer and Assistant Professor, Tsing Hua University (1937-50).

Publications:

3 papers on systematic botany.

WU CHIH-CHUNG

Field of work:

Medicine.

Present position:

Professor of Medicine, National Medical College, Shenyang.

Scientific training:

M.B., Mukden Medical College, Shenyang; Fellow, Royal Faculty of Physicians and Surgeons of Glasgow.

Positions previously held:

Assistant physician, Peking Union Medical College.

Professor of Medicine, and Dean, Hsiang Ya Medical College, Changsha.

Publications:

5 Papers on clinical medicine.

WU TSAI-TUNG

Field of work:

Pathology.

Present position:

Professor of Pathology and Head of the Department, Medical College, Nanking University.

Scientific training:

M.B., Shanghai Medical College (1931).

D.T.M. (Liverpool) (1934).

Post graduate study, Pathology, Institute of Leeds, London Hospital, and Charite, Berlin (1935-1937).

Positions previously held:

Professor of Pathology, Shanghai Medical College (1938-1943).

Professor of Pathology, Medical School of Tung-Chi University (1945-1946).

Chief of Diagnostic Laboratory, Central Hospital, Nanking.

Publications:

15 papers on pathology and other topics.

YANG SHIH-TA

Field of work:
Public health.
Present position:
Professor of Public Health and Director, School of Medicine, Aurora University, Shanghai.
Scientific training:
M.D., School of Medicine, Aurora University 1926. Diplomé de l'Institute Médico-Légal de l'Université de Paris (1927).
Positions previously held:
Professor, Chekiang Provincial School of Medicine and Pharmacy.
Publications:
3 papers on public health and therapeutics.

YEH MING-HAN

Field of work:
Nuclear Physics.
Present position:
Research Assistant, Institute of Modern Physics, Academia Sinica.
Scientific training:
B.S., Tsinghua University (1949).

YEN CHING-CH'ING

Field of work:
Public health.
Present position:
Professor and Head of the Department of Public Health, Peking University Medical College.
Commissioner of Public Health, People's Government of Peking.
Scientific training:
M.D., Peking Union Medical College (University of the State of New York).
M.P.H., Harvard School of Public Health.

YEN JEN-YING

Field of work:
Gynecology and obstetrics.
Present position:
Assistant Professor of Obstetrics and Gynecology, Peking University Medical College.

Scientific training:

M.D., Peking Union Medical College (University of the State of New York).

Post graduate study, College of Physicians and Surgeons, Columbia University (1948-1949).

Positions previously held:

Assistant Resident, Peking Union Medical College Hospital (1940-1942).

Lecturer, Peking University Medical College (1946-48).

Publications:

2 Papers on obstetrics and gynecology.

YUAN HSIU-SHUN

Field of work:

Chemical analysis.

Present position:

Technical Assistant, Chemical Laboratory, Institute of Science, Ministry of Industries, People's Government of Northeast China.

YU TE-TSUN

Field of work:

Systematic botany.

Present position:

Research Member, Institute of Systematic Botany, Academia Sinica.

Scientific training:

B.Sc., Normal University (1930).

Research work in University of Edinburgh (1948-50).

Positions previously held:

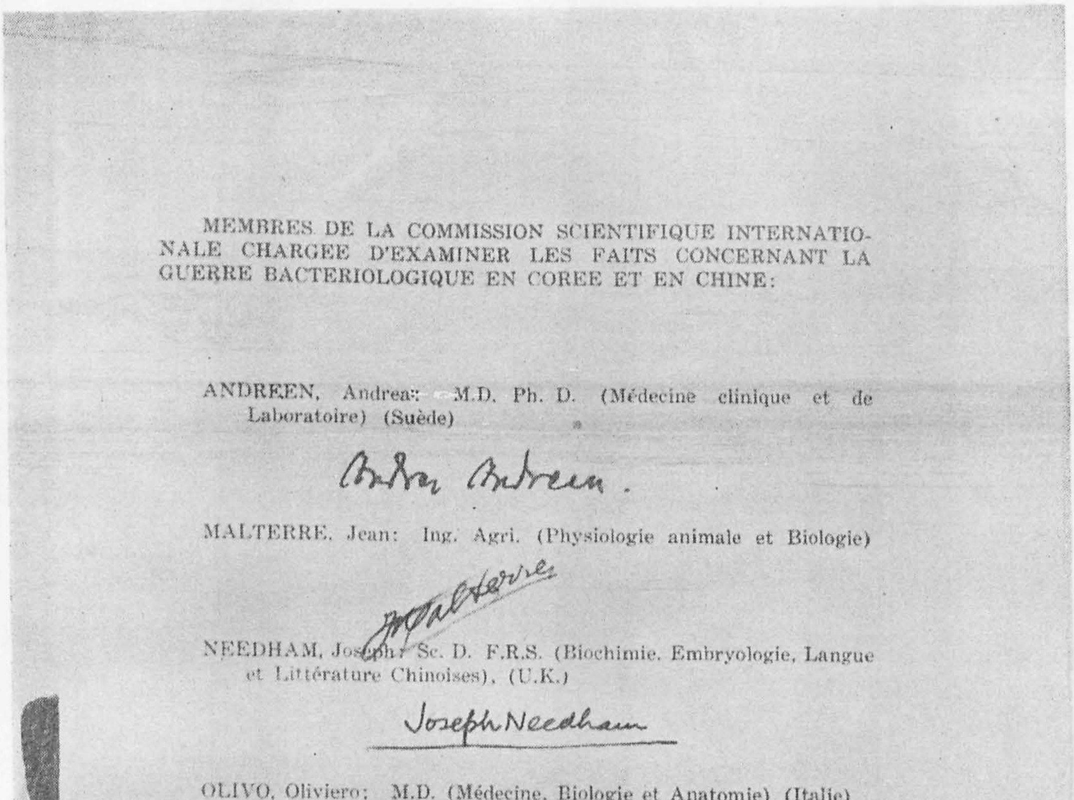
Associate research member, Fan Memorial Institute of Biology.

Vice Director, Yunnan Botanical Institute.

Professor, Yunnan University.

Publications:

5 articles on systematic botany.



MEMBRES DE LA COMMISSION SCIENTIFIQUE INTERNATIONALE CHARGEE D'EXAMINER LES FAITS CONCERNANT LA GUERRE BACTERIOLOGIQUE EN COREE ET EN CHINE:

ANDREEN, Andrea: M.D. Ph. D. (Médecine clinique et de Laboratoire) (Suède)

Andrea Andreen.

MALTERRE, Jean: Ing. Agri. (Physiologie animale et Biologie)

NEEDHAM, Joseph: Sc. D. F.R.S. (Biochimie, Embryologie, Langue et Littérature Chinoises), (U.K.)

Joseph Needham

OLIVO, Oliviero: M.D. (Médecine, Biologie et Anatomie) (Italie)

PESSOA, Samuel, B.: M.D. (Parasitologie et Entomologie Médicales) (Brésil)

ZHUKOV-VEREZHNIKOV, Nicolai Nicolaievitch: M.D. Membre de l'Académie de Médecine (Bactériologie et Epidémiologie) (U.R.S.S.)

Pékin, le 31 Août 1952.

Photograph of the Signatures of Members of the International Scientific Commission


Members of the International Scientific Commission
TSIEN SAN-TSIANG
Liaison
Member
(China)
Mme. PESSOA
Secretary
Interpreter
(Brazil)
F. GRAZIOSI
Consultant
Observer
(Italy)
N. A. KOWALSKI
Secretary
Interpreter
(U.S.S.R.)
J. NEEDHAM
(U.K.)
(Sweden)
O. OLIVO
(Italy)
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